
JOURNAL
OF THE
ARNOLD ARBORETUM

VOL. XXIV

APRIL, 1943

NUMBER 2

TAXONOMIC NOTES ON THE OLD WORLD SPECIES
OF WINTERACEAE

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With six text-figures

As implied by the title, this treatment is not monographic, its scope being primarily to bring together references to the taxonomic literature, to indicate the acceptable name for each species, to discuss the typification of species and genera, to mention the known distribution, and to cite the specimens available in American herbaria. From some regions there is a deplorable lack of available herbarium material in this country, and consequently my remarks must often be based upon those of previous workers. Some revision of specific lines will be inevitable when European herbaria can again be consulted, and doubtless a certain amount of revision will be dictated by future collections throughout the range of the family. For some of the genera in certain regions, such as New Guinea and Australia, enough material is available to make feasible the preparation of preliminary keys, but these are presented with the reservation that modification and expansion will be essential.

Prof. I. W. Bailey and the writer have in preparation a treatment of the inter-relationships of the six genera which make up the Winteraceae and the place of the family in the Ranales. Consequently, in the present paper I omit comprehensive generic descriptions and detailed discussions of generic relationships. During the preparation of this work, I have repeatedly called upon Prof. Bailey for advice, and many of the conclusions expressed are the result of his painstaking preparation and examination of material for microscope study. It is hoped that the present paper will provide an outline of the classification of the family and will bring up to date the sometimes complicated synonymy.

The Winteraceae has an interesting bihemispheric and presumably palaeoantarctic distribution, which I have recently discussed (5). In the Old World, species are found in the area roughly outlined by the Philippines, Borneo, New Guinea, the Solomon Islands, New Caledonia, New

Zealand, Tasmania, and eastern Australia. All of the six known genera occur in this region, while only one, *Drimys*, extends to America, where it is found from Cape Horn to southern Mexico. According to my interpretation, the family now contains about 88 species, of which only four are American. The type genus is *Drimys* (of which *Wintera* is a synonym), and the type species of *Drimys* is *D. Winteri* J. R. & G. Forst. of southern South America. This species, therefore, is the nomenclatural basis of the family.

Many students have included *Drimys* and *Illicium* L. in the same family, subfamily, or tribe. There appear to be no sound morphological, anatomical, or genetic reasons for this broad concept. The wood structure, nodal anatomy, pollen grain, carpellary structure, and many other characters of *Illicium* remove it from the Winteraceae. Whitaker (8) has pointed out that *Illicium* cytologically bears no resemblance to either *Drimys* or members of the Magnoliaceae, being suggestive, in its chromosome number, of *Schizandra* and *Kadsura*. Therefore the genus is not considered in connection with the present study; whether it should be placed in the Schizandraceae or in an independent family must be decided by future study.

The directors and curators of the following institutions have kindly loaned herbarium material, which is cited in this paper as indicated by the parenthetical letters: Arnold Arboretum (A), Field Museum of Natural History (F), Gray Herbarium (GH), Missouri Botanical Garden (M), New York Botanical Garden (NY), University of California (UC), and U. S. National Museum (US).

WINTERACEAE Lindl. Nat. Syst. Bot. ed. 2. 17, pro parte. 1836; Miers in Ann. Mag. Nat. Hist. III. 2: 33, pro parte. 1858, Contrib. Bot. 1: 123, pro parte. 1861; Eichl. in Mart. Fl. Bras. 13(1): 127. 1864; Hutchinson in Kew Bull. 1921: 185, pro parte. 1921, Fam. Fl. Pl. Dicot. 81, pro parte. 1926.

Winterae R. Br. ex DC. Reg. Veg. Syst. Nat. 1: 548, pro parte. 1817; Lindl. Introd. Nat. Syst. Bot. 26, pro parte. 1830, Nixus Pl. 9, pro parte. 1833.

Magnoliaceae Trib. Illicieae DC. Prodr. 1: 77, pro parte. 1824.

Magnoliaceae Trib. Winterae R. Br. ex Meisn. Pl. Vasc. Gen. 3 (pars alt. 5), pro parte. 1836; Benth. & Hook. f. Gen. Pl. 1: 17, pro parte. 1862.

Magnoliaceae Subordo Illicieae DC. ex Endl. Gen. Pl. 838, pro parte. 1839.

Magnoliaceae Trib. Illicieae Sect. Winterineae Spach, Hist. Nat. Veg. 7: 435. 1839.

Magnoliaceae II. Winterae Lindl. Veg. Kingd. ed. 2. 419, pro parte. 1847, ed. 3. 419, pro parte. 1853.

Magnoliaceae III. Illicieae Prantl in E. & P. Nat. Pfl. III. 2: 18, pro parte. 1891.

Magnoliaceae Subfam. Drimydoideae Harms in Ber. Deutsch. Bot. Gesell. 15: 358. 1897.

Drimytacées v. Tiegh. in Jour. de Bot. 14: 354. 1900.

Drimytacées Trib. Drimytées and Trib. Exospermées v. Tiegh. in Jour. de Bot. 14: 354. 1900.

Drimytaceae Diels in Bot. Jahrb. 55: 133. 1917.

Magnoliaceae Subfam. Drimydoideae Skottsb. in Växternas Liv 5: 349, pro parte. 1940.

The principal interpretations of the taxonomic position of the group now known as the Winteraceae are indicated by the above synonymy. Most of the early writers linked *Drimys* and *Illicium* in the same tribe or section,

but the classification of Spach, in 1839, is interesting because of his proposal of different sections of the Tribe Illicieae for these two genera. Harms' concept of Magnoliaceae Subfam. Drimyoideae (1897) is synonymous with the Winteraceae in the modern sense. The most precise delimitation of the family, however, has been that of van Tieghem (6), who apparently neglected to use the Latin form of his "Drimytacées" anywhere in his treatment.

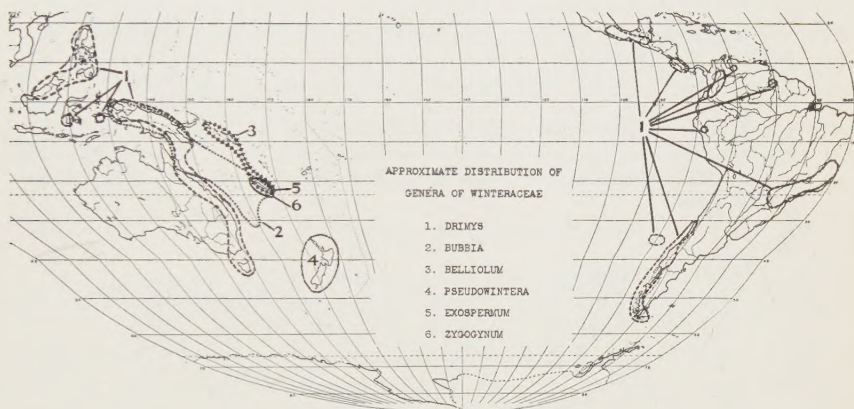


FIG. 1. Approximate distribution of the genera of Winteraceae. From Goode's series of base maps, no. 108.

KEY TO THE GENERA IN THE OLD WORLD

- Calyx submembranaceous or papyraceous, calyptrate, completely enclosing the bud, at length splitting into 2 or 3 lobes and often caducous; plants dioecious or polygamodioecious; carpels free, with the stigmatic surface extended along the ventral suture; anther-locules vertical or subvertical, distally extrorse-lateral, the filaments comparatively slender, subterete 1. *Drimys* Sect. *Tasmania*.
- Calyx papyraceous to subcoriaceous, persistent, often rotate, not calyptrate, not enclosing the bud; plants hermaphrodite; carpels often with a short stigmatic ridge (or elliptic or subpeltate stigma in *Zygogynum*); filaments carnosae, flattened.
- Carpels free, sometimes appressed-contiguous (in *Bubbia* and *Exospermum*), not developing into a syncarp.
- Inflorescence terminal or pseudoterminal, the flowers or inflorescence-rays aggregated around the growing point.
- Anther-locules apical, horizontal or oblique at the apex of distally enlarged filaments, not exceeded by the connective.
- Carpels usually free even in young flowers, rarely appressed-contiguous at anthesis; placental surface essentially corresponding to the external stigmatic surface 2. *Bubbia*.
- Carpels appressed-contiguous, free only after anthesis; placentation diffuse and scattered on distal surfaces 5. *Exospermum*.
- Anther-locules vertical, extrorse-lateral, exceeded apically by the connective 3. *Belliolum*.
- Inflorescence axillary; flowers fasciculate (rarely solitary), often arising from branchlets of several years' growth 4. *Pseudowintera*.
- Carpels firmly concrescent, the placentation primarily on the dorsal surface; fruit a syncarp 6. *Zygogynum*.

1. DRIMYS

Drimys J. R. & G. Forst. Char. Gen. 83. 1776.

The Old World representatives of the genus all belong in the Section *Tasmannia*, which is separable from the American Section *Wintera* as pointed out in my recent treatment of that group (4: 10). I have already listed the principal references to the genus *Drimys* as a whole, and consequently the following references pertain only to the Old World portion of the genus.

Drimys Sect. **Tasmannia** (R. Br.) F. v. Muell. Pl. Indig. Col. Vict. **1**: 20. 1860; Baill. Hist. Pl. **1**: 160. 1867-69.

Tasmannia R. Br. ex DC. Reg. Veg. Syst. Nat. **1**: 445, 547. 1817, ex DC. Prodr. **1**: 78. 1824; Lindl. Nat. Syst. Bot. ed. 2. 17. 1836; Meisn. Pl. Vasc. Gen. 3 (pars alt. 5). 1836; Spach, Hist. Nat. Veg. **7**: 433. 1839; Endl. Gen. Pl. 838. 1839, Enchir. Bot. 428. 1841; Lindl. Veg. Kingd. ed. 2. 419. 1847; Hook. f. Fl. Tasm. **1**: 10. 1855; Miers in Ann. Mag. Nat. Hist. III. **2**: 109. 1858, Contrib. Bot. **1**: 138. 1861.

Drimys J. R. & G. Forst. sensu Benth. Fl. Austral. **1**: 49. 1863; F. M. Bailey, Queensl. Fl. **1**: 18. 1899.

Drimys Sect. *Winterana* Baill. Hist. Pl. **1**: 160. 1867-69.

Drimys Sect. *Eudrimys* v. Tiegh. in Jour. de Bot. **14**: 288, pro parte. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108, pro parte. 1906; non DC. (1824).

Drimys occurs in the Old World in Australia and Tasmania, New Guinea, the Philippines, Borneo, Celebes, and Amboina. Its occurrence in other high eastern Malayan islands is possible, but thus far no other regions are represented in the herbaria examined by me, nor have published records of other occurrences been found. It is a typically montane genus, reaching elevations of 3800 m. in New Guinea and Borneo, but descending to sea-level in the southern part of its range in Tasmania. Six species are known from Australia and Tasmania, 29 from New Guinea, and one from the Philippines-Amboina region. In order to make this treatment more usable, I propose to discuss and key the Australian and the New Guinean-Malayan species separately.

The genus *Tasmannia* was originally based on *T. aromatica* R. Br. and *T. insipida* R. Br., Australian species which are referable to *Drimys lanceolata* (Poir.) Baill. and *D. insipida* (R. Br.) Pilger respectively. The Sections *Tasmannia* and *Wintera* are sharply differentiated, but their common origin is indisputable and the separating characters do not seem generic in quality. The total variability of *Drimys* in the Old World, especially in New Guinea, is considerable, particularly when the region is compared to America, where, in an area extending from southern Mexico to Cape Horn, no more than four species can be recognized. I have attempted to use essentially similar standards for specific delimitation in the two hemispheres. In spite of the greater number of Old World species, it is much easier to draw specific lines in Sect. *Tasmannia* than in Sect. *Wintera*, while intraspecific variability seems much less pronounced in the Old World than in the New. From this fact one might assume that isolating mechanisms have been at work longer in Sect. *Tasmannia* than in

Sect. *Wintera* and that extensive interchange of genetic material between parts of the population ceased earlier in the Old World than in the New.

Following De Candolle's treatments, many subsequent writers maintained the genus *Tasmannia* as distinct from *Drimys*, but modern students have submerged it. I believe that it is well retained as a section with a status similar to that of the American Section *Wintera* (Murr.) DC. Baillon proposed to divide *Drimys* into four sections, but one of these, Sect. *Winterana*, is difficult to typify from his brief treatment. I assume that he meant to base it on "*Winterania*" *lanceolata* Poir., an Australian species, and consequently I list it as a synonym of Sect. *Tasmannia*. Van Tieghem's four sections of *Drimys* are all based exclusively on American species with the exception of Sect. *Eudrimys*, which, curiously enough, includes the most extreme forms of the genus. The Old World representatives of van Tieghem's Section *Eudrimys* are referable to Mueller's Sect. *Tasmannia*, but the actual type of Sect. *Eudrimys* v. Tiegh. is the American *D. Winteri*.

AUSTRALIAN SPECIES

The six recognizable Australian species are quite distinct from the New Guinean representatives, all being characterized by having their pistillate flowers lacking stamens (a feature of only a few New Guinean species). However, the Australian species do not appear to form a single coherent group, and it is not to be assumed that they were derived from a single recent prototype. *Drimys lanceolata* and its two allies (*D. stipitata* and *D. Vickeriana*) are entirely distinct from any New Guinean species and appear to have no close relatives; they have probably been isolated for a long time from the main trends of evolution in the Section *Tasmannia*.

The only Australian species which appears to have a close affinity with the New Guinean species is, as might be expected, *D. membranacea*, of Queensland, which has much in common with *D. hatamensis* Becc. This relationship has already been suggested by Diels (in Bot. Jahrb. **54**: 242. 1916). However, *D. hatamensis* (like its closest New Guinean allies *D. dictyophlebia* Diels and *D. coriacea* Pulle) has pistillate flowers with at least three carpels, while those of *D. membranacea* have a single carpel. There are also differences in the shape of the perianth-parts and fruits, but in foliage the Queensland species and *D. hatamensis* are remarkably similar.

Ridley (in Trans. Linn. Soc. II. Bot. **9**: 12. 1916) has pointed out the possible relationship of his *D. densifolia* to *D. insipida* (i. e. *D. dipetala*), but the Australian species differs in its narrower leaves, larger petals, more numerous stamens in staminate flowers, and usually solitary carpel. The actual relationship of these two species is probably quite remote, in spite of the similarity of their leaf-bases.

It seems desirable to redescribe three of the older Australian species and one novelty, but I do not find it necessary to repeat Vickery's excellent descriptions (7) of *D. purpurascens* and *D. stipitata*.

KEY TO THE AUSTRALIAN SPECIES

- Leaf-blades with (5-)7-18 short anastomosing secondary nerves, these erecto-patent at an angle of (20-)30-45°, the blades (4-)6-20 cm. long; petals 2, very rarely 3.
- Leaf-blades gradually narrowed toward a suddenly obtuse and often auriculate base; carpels 1 (rarely 2) in both staminate and pistillate flowers; fruit 1-carpellate, ellipsoid, usually 13-20 mm. long, obtuse at base, with (8-)15-27 seeds 1. *D. insipida*.
- Leaf-blades acute to attenuate at base.
- Petals up to 8 mm. long at anthesis; filaments 0.5-3.5 mm. long; carpels 1 (rarely 2 or 3) in both staminate and pistillate flowers; fruit 1-carpellate, often nearly subglobose, not more than 10 mm. long, rounded at base, usually with 4-7 seeds 2. *D. membranacea*.
- Petals 10-12 mm. long; filaments 2-6 mm. long; carpels 2-8 in both staminate and pistillate flowers; fruit 2-8 (usually 3- or 4-)carpellate, the carpels oblong-globose, 10-15 mm. long, short-stipitate 3. *D. purpurascens*.
- Leaf-blades with 3-7 elongate secondary nerves, these sharply ascending at an angle of 10-20° or completely immersed and obscure, the blades not exceeding 11 cm. in length, acute to attenuate at base, never auriculate.
- Sepals 3.5-6 mm. in diameter; petals 4-9 mm. long, 1.5-3.5 mm. broad; stamens in staminate flowers 15-45; fruiting carpels with at least 6 seeds; leaf-blades rarely less than 4 cm. long and 1 cm. broad.
- Petals in staminate flowers 5-8, in pistillate flowers usually 4; carpels in both staminate and pistillate flowers 1, rarely 2 or 3, subglobose or ellipsoid, sessile, the stigmatic ridge occupying the entire apex and ventral edge; fruit 1-carpellate, essentially subglobose, rounded at base 4. *D. lanceolata*.
- Petals 2; carpels in staminate flowers 1 or 2, in pistillate flowers 2-8, obovoid-ellipsoid, obviously stipitate, the stigmatic ridge obliquely apical or extending to base of ovary; fruit 2-8 (usually 3- or 4-)carpellate, the carpels oblong-ellipsoid, conspicuously stipitate 5. *D. stipitata*.
- Sepals 2.5-3 mm. in diameter; petals 2, not exceeding 3 mm. in length and 1 mm. in breadth at anthesis; stamens in staminate flowers 10-12; carpel in staminate flowers 1, subsessile; fruit 1-carpellate, subglobose, with about 3 seeds; leaves congested, the blades small, up to 16 mm. long and 5 mm. broad 6. *D. Vickeriana*.
1. ***Drimys insipida*** (R. Br.) Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Druce in Rep. Bot. Exch. Cl. Brit. Isles **1916**: 620. 1917; Domin in Bibl. Bot. **22** [Heft 89]: 115. 1925; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 82. 1937.
- Tasmannia insipida* R. Br. ex DC. Reg. Veg. Syst. Nat. **1**: 445. 1817; DC. Prodr. **1**: 78. 1824; Miers in Ann. Mag. Nat. Hist. III. **2**: 110. 1858; F. v. Muell. Pl. Indig. Col. Vict. **1**: 21, as synonym. 1860; Miers, Contrib. Bot. **1**: 140. 1861.
- Tasmannia dipetala* R. Br. ex DC. Prodr. **1**: 78, as synonym. 1824.
- Tasmannia monticola* A. Rich. Sert. Astrolab. 50. 1834 (Atlas pl. 19. 1833); F. v. Muell. Pl. Indig. Col. Vict. **1**: 21, as synonym. 1860.
- Drimys dipetala* F. v. Muell. Pl. Indig. Col. Vict. **1**: 21. 1860; Benth. Fl. Austral. **1**: 49. 1863; Baill. Hist. Pl. **1**: 160. 1867-69; F. M. Bailey, Syn. Queensl. Fl. **5**. 1883; C. Moore, Handb. Fl. N. S. Wales **13**. 1893; Maiden in Agric. Gaz. N. S. Wales **5**: 600 (Dorrigo For. Res. 8). 1894; Parment. in Bull. Sci. Fr. & Belg. **27**: 227, 301. 1896; F. M. Bailey, Queensl. Fl. **1**: 18. 1899; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; F. M. Bailey, Compr. Cat. Queensl. Pl. **21**. f. 7. 1913; Maiden & Betche, Census N. S. Wales Pl. **79**. 1916.
- Shrub or small tree, up to 3 m. or more high, the branchlets subterete, brownish or nigrescent, rugulose, slender, 1-3 mm. in diameter near apices; leaves scattered, sometimes appearing subopposite toward apex of branchlets; petioles rugulose, shallowly canaliculate, often inconspicuous, 0.5-4 mm. long, 0.7-2 mm. in diameter; leaf-blades chartaceous, brownish or



FIG. 2. Approximate known distribution of the Australian and Tasmanian species of *Drimys*. From Goode's series of base maps, no. 107.

dark green when dried, oblong- or obovate-lanceolate, (4-)8-20 cm. long, (0.7-)1.5-3.7 cm. broad, gradually narrowed to an abruptly obtuse or inconspicuously auriculate base, gradually and often long-acuminate at apex, slightly recurved at margin, the costa slightly raised or narrowly canaliculate above, prominent beneath, the secondary nerves 7-18 per side, short, erecto-patent at an angle of (20-)30-45°, usually freely anastomosing toward margin, prominulous on both surfaces, the veinlets loosely reticulate and faintly prominulous or obscure on both surfaces; flowers single, numerous, congested around the growing point of branchlets, at length pseudolateral, subtended by numerous bracts, these papyraceous, oblong, 5-11 mm. long, obtuse, soon caducous, the pedicels slender, 10-25 mm. long at anthesis (sometimes shorter in pistillate plants), up to 30 mm.

long in fruit; staminate flowers: sepals 2, submembranaceous, densely but obscurely yellow-glandular, ovate-deltoid, 5–7 mm. long and broad, obtusely apiculate at apex; petals 2, submembranaceous, eglandular to densely glandular-punctate, obovate- or spatulate-linear, 7.5–13 mm. long, 1.5–2.5 mm. broad, conspicuously narrowed at base, obtuse at apex; stamens usually 30–38, 3- or 4-seriate, the filaments subcarinose, ligulate, obscurely pellucid-glandular, 1–5 mm. long, the locules 1–2 mm. long; carpel 1 (rarely 2), sterile, ellipsoid, slightly falcate, often yellow-glandular, 2.5–4 mm. long at anthesis, the stigmatic ridge elongate; pistillate flowers: sepals as in staminate but usually longer than broad, obtuse at apex; petals similar but smaller, up to 10 mm. long, 1–1.5 mm. broad; stamens none; carpel 1, ellipsoid, about 3 mm. long at anthesis, obtuse at apex, the stigmatic ridge extending from apex nearly to base, the ovules about 28; fruit 1-carpellate, ellipsoid, at maturity (9–)13–20 mm. long and (5–)7–10 mm. broad, obtuse at base and apex, obscurely marked ventrally by the stigmatic ridge, the pericarp carinose, copiously yellow-glandular, the seeds (8–)15–27, loosely imbedded in sparse mucilaginous pulp, coriaceous, black, shining, obovoid, slightly or strongly falcate, 3–3.5 mm. long, 1.5–2.5 mm. broad, acute at base, rounded at apex.

DISTRIBUTION: Southeastern Queensland and eastern New South Wales, from about lat. 24° to 35°30', from sea-level to about 1500 m. in mountains; usually reported as occurring in rain-forest. The type was collected by Brown at or near Port Jackson.

AUSTRALIA: Queensland: Fraser Island, *Epps* 229 (NY); Tinana Creek, *White* 3476 (A); Imbil, *Wilson* (A); Eumundi, *Simmonds* (A); Tallebudgera, *White* 1866 (A); Roberts Plateau, Lamington National Park, *White* 6062 (A, NY); Cunningham's Gap, Main Range, *White* 6862 (A, NY); Mt. Spurgeon, *White* 10737 (A); Mt. Greville, *White* 9949 (A), *Everist* 556 (A); Tambourine Mt., *White* 3568 (A); National Park, Macpherson Range, *White* (A); Mistake Range, *White* (A), *Bailey* (US); New South Wales: Richmond River, *Henderson* (UC); Upper Williams River at Salisbury, *White* 11473 (A); Wentworth Falls, *Burges* (NY); Moonambale, *Maiden* (A); Port Jackson, *Caley* (A).

NATIVE NAME: *Pepper shrub*.

White reports the sepals as red, the petals paler red, and the stamens yellow; other collectors have not mentioned the flower-color. The fruit is usually noted as purple to black at maturity, but some collectors indicate that it is white (probably only when juvenile).

The first occurrence of the name *Tasmannia dipetala* in literature is De Candolle's reference to it, in the *Prodromus*, as a synonym of *T. insipida*. In transferring the species to *Drimys*, Mueller unfortunately selected the epithet *dipetala* and has been followed by many students. The correct transfer of the epithet *insipida* was apparently first made in 1906. Subsequently to Pilger's publication of the binomial *Drimys insipida*, both Druce and Domin proposed the combination as new.

Richard's description and illustration of *Tasmannia monticola* portray an apparently hermaphrodite flower, with numerous stamens and two fertile carpels. In staminate flowers of *D. insipida* one occasionally finds two carpels, but these are always sterile; the fact that Richard illustrates ovules suggests either faulty observation or a very unusual individual, since there can be no doubt of the identity of his plant with *D. insipida*.

2. *Drimys membranacea* F. v. Muell. Fragm. Phyt. Austr. **5**: 175. 1866; F. M. Bailey, Syn. Queensl. Fl. **5**. 1883; Parment. in Bull. Sci. Fr. & Belg. **27**: 227, 302, as *D. membranacea*. 1896; F. M. Bailey, Queensl. Fl. **1**: 18. 1899; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108, as *D. membranacea*. 1906; F. M. Bailey, Compr. Cat. Queensl. Pl. **21**. 1913.

Shrub or tree up to 15 m. high, the branchlets subterete or slightly angled, rugulose, brownish, 1.5–4 mm. in diameter near apices; leaves often more or less congested toward apices of branchlets, the petioles stout, 1–2 mm. broad, often flattened and narrowly winged, 1–7 mm. long; leaf-blades chartaceous or subcoriaceous, brownish when dried, narrowly obovate, (4–)6–13 cm. long, (1–)1.5–4.3 cm. broad, gradually attenuate at base and decurrent on the petiole, obtusely cuspidate or short-acuminate at apex, slightly recurved at margin, the costa broad, slightly raised or shallowly canaliculate above, usually subprominent beneath, the secondary nerves (5–)8–14 per side, erecto-patent at an angle of 30–45°, prominulous on both surfaces, freely anastomosing near margin, the veinlets reticulate, faintly prominulous on both surfaces; flowers single, clustered around growing point of branchlets, at length pseudolateral, subtended by bracts, these papyraceous, oblong, about 5 mm. long, soon caducous, the pedicels slender, 12–33 mm. long (sometimes shorter in pistillate plants); staminate flowers: sepals 2, submembranaceous, eglandular or obscurely yellow-glandular, suborbicular-deltoid, 4–5.5 mm. long and broad, obtuse or rounded at apex; petals 2, similar to sepals in texture, obovate-linear, about 8 mm. long and 2–3.5 mm. broad at anthesis, narrowed to base, obtuse or rounded at apex; stamens 25–35, 3- or 4-seriate, the filaments subcarnose, subterete-ligulate, obscurely yellow-glandular, 0.5–3.5 mm. long, the locules 0.7–1.3 mm. long; carpels 1 or 2 (or 3, ex Mueller), sterile, obovoid-ellipsoid, 2.5–3 mm. long at anthesis, the stigmatic ridge obvious, elongate; pistillate flowers: sepals and petals similar to staminate in texture, the sepals ovate-oblong, 3.5–6 mm. long, 2.5–3 mm. broad, the petals about 8 mm. long and 2–2.5 mm. broad; stamens none; carpel 1, ellipsoid, 2.5–4 mm. long at anthesis, short-stipitate, the stigmatic ridge obvious, extending from apex nearly to base, the ovules 14–36 (or possibly sometimes more, with some aborted); fruit 1-carpellate, oblong-ellipsoid to nearly subglobose, 6–10 mm. long and 5–7 mm. broad at maturity, rounded at base and apex, the stigmatic ridge elongate, obscure, the pericarp carnose, obscurely yellow-glandular, the seeds usually 4–7 (with many aborted), black, shining, obovoid, slightly falcate, 3–3.5 mm. long and about 2 mm. broad at maturity, subacute at base, rounded at apex.

DISTRIBUTION: Eastern Queensland, from about lat. 16° to 18°, at elevations of 800–1600 m. (or perhaps occurring down to sea-level); in rain-forest or low bush, sometimes common (Kajewski).

AUSTRALIA: Queensland: Thornton Peak, *Brass 2291* (A); Gadgarra, Peeramon, Atherton, *Kajewski 1065* (A, NY, UC); Mt. Bartle Frere, *Kajewski 1291* (A, NY); Bellenden Ker, near summit, *White* (A); Rockingham Bay, *Dallachy* (GH, NY).

The sepals and petals are reported as white by Brass, green by Kajewski; the mature fruit is said to be black. The young leaves, bracts, and sometimes the whole plant are often tinged with purple.

Mueller's original description is based on an apparently staminate specimen collected by Dallachy "ad fontes fluminis Mackay-River," whereas

the Dallachy specimens cited above, from Rockingham Bay, are pistillate. The type specimen must have very young leaves, as none of those seen by me could be considered membranaceous. Mueller describes the petals as 2 or 3, but all my specimens have them 2.

Drimys membranacea is doubtless a close relative of *D. insipida*, which it resembles in leaf-shape and texture, differing primarily in the quite different leaf-base. Both species have the sepals and petals of the pistillate flowers narrower than those of the staminate. In *D. membranacea* both sepals and petals are shorter and usually proportionately narrower. The fruit of *D. membranacea* appears to be consistently smaller and with fewer seeds than that of *D. insipida*.

3. ***Drimys purpurascens*** Vickery in Proc. Linn. Soc. N. S. Wales **62**: 78. *f. 1*; *pl. 5*. 1937; Fraser & Vickery, l. c. 288. 1937.

DISTRIBUTION: Thus far known only from a restricted area on the Mt. Royal Ranges in the vicinity of the Barrington Tops, New South Wales, at an altitude of 1350-1500 m.

AUSTRALIA: New South Wales: Barrington Tops, Boorman (US), White 11472 (A).

The original description is very complete, being based upon several collections from the same locality; the type is *Fraser & Vickery* (in May, 1936). The species is readily distinguished from its allies, *D. insipida* and *D. membranacea*, by its more numerous carpels and several-carpellate fruits, as well as by its usually broader leaf-blades and broad subulate petioles. White indicates that the species is very common locally in both rain-forest and *Eucalyptus* forest.

4. ***Drimys lanceolata*** (Poir.) Baill. Hist. Pl. **1**: 159. *f. 205-207*. 1867-69; Parment. in Bull. Sci. Fr. & Belg. **27**: 225, as synonym. 1896; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Ewart, Fl. Vict. 517. 1930; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 82. 1937; Fraser & Vickery, l. c. 288. 1937.

Winterania lanceolata Poir. Encycl. **3**: 799. 1808.

Tasmannia aromatica R. Br. ex DC. Reg. Veg. Syst. Nat. **1**: 445. 1817; Deless. Ic. Sel. **1**: 22. *pl. 84*. 1820; DC. Prodr. **1**: 78. 1824; Lindl. Bot. Reg. **31**: *pl. 43*. 1845; Hook. f. Fl. Tasm. **1**: 11. 1855; Miers in Ann. Mag. Nat. Hist. III. **2**: 110. 1858, Contrib. Bot. **1**: 139. 1861; Baill. Hist. Pl. **1**: 159, as synonym. 1867-69; Meredith, Bush Friends Tasm. Ser. Ult. *pl. 11*. 1891.

Drimys aromatica F. v. Muell. Pl. Indig. Col. Vict. **1**: 20. 1860; Benth. Fl. Austral. **1**: 49. 1863; F. v. Muell. Nat. Pl. Vict. **1**: 19. 187. *f. 44*. 1879, Key Syst. Vict. Pl. **2**: 6. *pl. 3*. 1885, op. cit. **1**: 121. 1888; C. Moore, Handb. Fl. N. S. Wales 13. 1893; Parment. in Bull. Sci. Fr. & Belg. **27**: 225, 298. *pl. 11*, *f. 41*. 1896; Rodway, Tasm. Fl. 5. 1903; De Wildem. in Ic. Sel. Hort. Then. **5**: 127. *pl. 191*. 1906; Maiden & Betche, Census of N. S. Wales Pl. 79. 1916; Ewart, Handb. For. Trees Vict. For. 116. 1925; Johnstone in Jour. Roy. Hort. Soc. **62**: 96. *f. 25*. 1937.

Drimys aromatica var. *aromatica* Parment. in Bull. Sci. Fr. & Belg. **27**: 226. 1896. *?Drimys xerophylla* Parment. in Bull. Sci. Fr. & Belg. **27**: 226, 299, *nomen subnudum*. 1896; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 83, as synonym. 1937.

Shrub or small tree, 2-10 m. high, the branchlets subterete or slightly angled, rugulose, reddish brown or purplish, slender, 1-3 mm. in diameter toward apices; leaves scattered, the petioles rugulose, shallowly canaliculate, 2-15 mm. long, 0.7-2 mm. in diameter, often swollen at base; leaf-blades subcoriaceous or chartaceous, pale green or yellow-green when dried, oblanceolate or narrowly elliptic-obovate, (3-)-4-11 cm. long, 0.6-3 cm.

broad, attenuate at base and decurrent on the petiole, obtuse or subacute at apex, narrowly recurved at margin, the costa subplane or slightly raised above, more obviously elevated beneath, the secondary nerves 3–7 per side, elongate, sharply ascending at an angle of 10–20°, inconspicuously anastomosing toward margin, immersed or prominulous above, prominulous beneath, the veinlets immersed or obscurely prominulous beneath; flowers single, aggregated around growing point of branchlets, at length pseudolateral, subtended by bracts, these papyraceous, oblong, obtuse, 4–13 mm. long, soon caducous, the pedicels slender, 8–25 mm. long (staminate flowers) or 4–12 mm. long (pistillate flowers and fruits); staminate flowers: sepals 2 (rarely 3), membranaceous, densely but obscurely pellucid-glandular, ovate-suborbicular, 3.5–6 mm. long and broad, obtuse at apex; petals 5–8, resembling sepals in texture, linear-oblong or narrowly obovate, 4–9 mm. long, 1.5–3.5 mm. broad, obtuse at apex; stamens 15–28, 2- or 3-seriate, the filaments eglandular, 0.7–3.5 mm. long, the locules ellipsoid, 0.9–1.3 mm. long, the carpel 1 (rarely 2 or perhaps 3), sterile, ellipsoid, 0.7–1 mm. long at anthesis, the stigmatic ridge obvious, occupying entire rounded apex and extending to base; pistillate flowers: sepals as in staminate or slightly narrower; petals 4 (in all available specimens), as in staminate but 3.5–5.5 mm. long and 0.7–2 mm. broad; stamens none; carpel 1 (rarely 2), subglobose or ellipsoid, about 1.5 mm. in diameter at anthesis, rounded at base and apex, the stigmatic ridge extending over apex and along entire ventral edge, the ovules 10–18; fruit 1-carpellate, oblong-subglobose or subglobose, often appearing obscurely bilobed, 5–10 mm. long and 5–8 mm. broad at maturity, rounded at base and apex, the stigmatic ridge elongate, the pericarp subcarinose, rugulose, obscurely yellow-glandular, the seeds 6–18, dark castaneous or black, shining, obovoid, strongly falcate, 2.5–3.5 mm. long, 1.3–2 mm. broad, acute at base, rounded at apex.

DISTRIBUTION: New South Wales, Victoria, and Tasmania, extending southward from about lat. 31°, at elevations up to 1200 m. in the north, occurring down to sea-level in Tasmania; usually found in wet forest in New South Wales and Victoria; abundant in Tasmania and forming dense thickets on margins of streams in rich humid soil.

AUSTRALIA: New South Wales: Hastings River, *Moore* (GH); Braidwood, *Baker* (US); Sugarloaf Mt., Braidwood, *Boorman* (US); Bago, *de Beuzeville* 201 (A); Tumbarumba, *Cambage* (GH); Victoria: *Kuntze* 20113 (NY); Mt. Baw Baw, *Melvin* (GH); Mt. Mueller, near Mt. Baw Baw, *Mueller* (GH); Tasmania: *R. Brown* s. n. or 2918 (type coll. of *Tasmannia aromatica*, F, GH, M, NY), *Gunn* (A, F, GH, M, US), *Archer* (GH); Golden Valley, toward Westbury Road, *Rodway* 125 (A); Mt. Wellington, *Gunn* 777 (GH, M), *Oldfield* (US); without definite locality: *Labillardiere* (TYPE COLL., GH), *Paterson* (A).

NATIVE NAMES: *Pepper-tree*, *native pepper*, *mountain pepper*, *wild pepper-corn*.

Mueller describes the petals as white with a red or green streak down the middle; colored plates show the petals as white, but none of the specimens seen by me have adequate color-notes.

Many of the descriptions cited above, such as those of Hooker, Mueller, and De Wildeman, are based on a more comprehensive concept than admitted in my description; these authors include in the species material from the Victorian Alps which is much reduced in foliage and floral char-

acters and which I describe below as *D. Vickeriana*. The species which Vickery has described as *D. stipitata* is also included in some of the early concepts of the present species, as indicated by references to the petals as 2–8 in number; I believe that *D. lanceolata* never has fewer than 4 petals. Mueller describes the ovaries as 1–11 and in some of his plates shows 4 carpels; his concept doubtless included specimens which are referable to *D. stipitata*, but even there no more than 8 carpels have otherwise been reported.

5. ***Drimys stipitata*** Vickery in Proc. Linn. Soc. N. S. Wales **62**: 80. f. 2. 1937.

Drimys aromatica var. *pedunculata* Maiden in Agric. Gaz. N. S. Wales **5**: 600 (Dorrigo For. Res. 8). 1894; Maiden & Betche, Census N. S. Wales Pl. 79. 1916.

DISTRIBUTION: Fairly common in northeastern New South Wales between about lat. 29° and 32°, at elevations of 600–1200 m., and also occurring near the boundary with Victoria perhaps at slightly higher altitudes; probably to be found elsewhere in New South Wales and in adjacent Victoria.

AUSTRALIA: New South Wales: Dorrigo Forest Reserve, Beilsdown Creek, Maiden in 1893 (type coll. of *D. aromatica* var. *pedunculata*, A); Dorrigo State Forest, toward Wild Cattle Creek, White 7572 (A, NY); Mt. Kosciusko, tree-line to about 2100 m., Maiden & Forsyth (UC); Snowy River, Cheel 813 (A, US).

The original description is ample and is based upon several additional collections, the type of the species being Maiden (in 1895), collected at Guy Fawkes. Although *D. stipitata* is scarcely distinguishable from *D. lanceolata* in foliage, the differences in number of petals and carpels, and especially in the shape of the carpels, are quite obvious. The carpels of the present species are conspicuously stipitate in fruiting specimens, and this character is also apparent in both staminate and pistillate flowers. However, there can be no doubt that *D. lanceolata* and *D. stipitata* are close relatives, and I believe that they are too far separated in Vickery's key (7: 83). The pistillate flowers, as in other Australian species, lack stamens, while carpels in the staminate flowers (1 or 2 in my material) are sterile.

6. ***Drimys Vickeriana*** sp. nov. FIG. 3, a-e.

Drimys aromatica var. *alpina* Parment. in Bull. Sci. Fr. & Belg. **27**: 226, 300, *nomen subnudum*. 1896.

Drimys lanceolata var. *parvifolia* Vickery in Proc. Linn. Soc. N. S. Wales **62**: 83. 1937.

Frutex compactus, ramis crassis multiramulosis, ramulis subteretibus cinereis apicem versus 1–3 mm. diametro cicatricibus foliorum delapsorum copiose ornatis; foliis dense congestis, petiolis rugulosis semiteretibus 1–3 mm. longis 0.8–1 mm. diametro, laminis coriaceis siccitate fuscis oblongis vel anguste ellipticis, 8–16 mm. longis, 2–5 mm. latis, basi acutis vel attenuatis, apice obtusis vel rotundatis, margine anguste recurvatis, costa supra obscura vel leviter insculpta subtus plana vel minute elevata, nervis secundariis utrinsecus circiter 3 ascendentibus utrinque immersis vel supra inconspicue impressis, venulis obscuris; floribus singulis aggregatis terminalibus demum pseudolateralibus, bracteis submembranaceis pellucidoglandulosis obovatis, 3–4 mm. longis, 2–2.5 mm. latis, apice rotundatis, mox caducis; pedicellis gracilibus teretibus 3–5 mm. longis; floribus ♂ solis visis: sepalis 2 submembranaceis glandulosis suborbicularibus 2.5–3 mm.

diametro, apice rotundatis; petalis 2 submembranaceis obovato-oblongis, sub anthesi 2.5–3 mm. longis et circiter 1 mm. latis, apice rotundatis; staminibus 10–12, 2-seriatis, filamentis subteretibus eglandulosis 0.5–1.5 mm. longis, loculis ellipsoideis 0.6–0.8 mm. longis; carpello unico sterili ellipsoideo sub anthesi circiter 1 mm. longo, basi et apice obtuso, carina stigmatum apicali-ventrali circiter 0.5 mm. longa; fructibus 1-carpellatis subglobosis maturitate 4–5 mm. diametro, pericarpio subcarnoso ruguloso



FIG. 3. a-e. *Drimys Vickeriana*, drawn from the type: a. flowering branchlet, $\times \frac{1}{2}$; b. staminate flower, $\times 3$; c. stamens, introrse and extrorse views, $\times 5$; d. sterile carpel, $\times 5$; e. sterile carpel, longitudinal section, $\times 5$. f-i. *Drimys microphylla*, drawn from the type: f. flowering branchlet, $\times \frac{1}{2}$; g. staminate flower, $\times 2$; h. stamens, extrorse and introrse views, $\times 5$; i. sterile carpel, $\times 5$. j-n. *Drimys obovata*, drawn from the type: j. flowering branchlet, $\times \frac{1}{4}$; k. young staminate flower, $\times 1\frac{1}{2}$; l. mature staminate flower, $\times 1\frac{1}{2}$; m. stamens, introrse and extrorse views, $\times 5$; n. sterile carpel, $\times 5$. o, p. *Drimys Brassii*, drawn from the type: o. fruit, showing three carpels, $\times 1$; p. seed, $\times 5$.

obscure glanduloso, seminibus circiter 3 castaneis nitidis obovoideis leviter falcatis, 2.5–3 mm. longis, 1.5–2 mm. latis, basi obtusis, apice rotundatis.

DISTRIBUTION: Southern portion of the Australian Alps, Victoria, at elevations of about 1200–1500 m.

AUSTRALIA: Victoria: Mt. Baw Baw, Mueller (US); Mt. Mueller, near Mt. Baw Baw, J. G. Luehmann & C. French in 1893 (GH, TYPE, UC), French in 1895 (GH, NY, UC).

No specimen is cited with Parmentier's brief note on *D. aromatica* var. *alpina*, but the specimen I have selected as the type of the new species bears this herbarium name; the type of *D. lanceolata* var. *parvifolia* is J. Staer in April 1911, from the Upper Yarra. In order to avoid ambiguity I have thought it better to propose the above-described entity as a new

species rather than to take up one of the varietal names. The species is named for Miss Joyce W. Vickery, in recognition of her work on the Australian *Drimys*. Additional specimens are cited with her varietal description, and she describes the leaf-blades as 8–23 mm. long, but none of those available to me exceed 16 mm.

Drimys Vickeriana is very distinct in its compact habit, small crowded leaves, small floral parts, reduced number of stamens and seeds, etc. Like *D. lanceolata*, it has a subglobose 1-carpellate fruit which is rounded at base, while it resembles *D. stipitata* in having only two petals. It appears to me to be one of the most distinct species of the genus, and I am unable to consider it merely a variety of either of its relatives.

NEW GUINEAN AND MALAYAN SPECIES

The Section *Tasmannia* reaches its greatest development in New Guinea, in its total variability, number of species, and number of individuals. Until the extensive exploration of New Guinea began, no more than forty years ago, the genus was supposed to occur there only sparsely, as represented by a very few collections referred to *D. hatamensis* Becc. and *D. piperita* Hook. f. We are now aware that the genus is one of the predominant elements in many of the montane regions of New Guinea, having been collected at all elevations between 800 and 3800 m. Its occurrence toward the lower limit of this altitudinal belt is presumably sparse, and therefore it was not observed in quantity until explorers gained access to the interior mountains. In this treatment I am able to recognize 29 species from New Guinea, although many of these are known to me only from the original descriptions. This number contrasts with the six species known from Australia and Tasmania and the single species known from the Philippines, Borneo, Celebes, and perhaps Amboina.

KEY TO THE NEW GUINEAN AND MALAYAN SPECIES

- Microphyllous species, probably always epiphytic, the leaf-blades 5–10 mm. long.
 - Petals 2, about 3 mm. long; stamens about 8, 1- or 2-seriate; leaf-blades 5–7 mm. long7. *D. vaccinioides*.
 - Petals 4–6, 4–5 mm. long; stamens 14–18, usually 3-seriate; leaf-blades (5–)6–10 mm. long8. *D. microphylla*.
- Small-leaved species, sometimes epiphytic, usually sclerophyllous, the leaf-blades (0.9–)1–4 (rarely to 5.5) cm. long.
 - Leaf-blades (9–)10–18 mm. long, 4–12 mm. broad; petals 2–4, up to 8 mm. long; stamens in staminate flowers 18–27, in hermaphrodite flowers 13–189. *D. buxifolia*.
 - Doubtfully distinct from preceding10. *D. Versteegii*.
 -11. *D. reducta*.
- Leaf-blades (1.5–)2–4 (–5.5) cm. long.
 - Petals none (rarely 1); stamens in staminate flowers 4–6; leaf-blades lanceolate-oblong, obtusely acuminate at apex.....12. *D. oligandra*.
 - Petals 2; stamens in staminate flowers probably 12–27; leaf-blades elliptic- or oblong-obovate, obtuse or rounded at apex.
 - Leaf-blades with obvious venation, (10–)15–25 mm. broad; stamens in pistillate flowers none; petals 4–4.5 mm. long; carpels 2–4; ovules about 1613. *D. rubiginosa*.
 -13. *D. rubiginosa*.
 - Leaf-blades with immersed venation.

- Carpels in hermaphrodite flowers 5 or 6; stamens 20-25; leaf-blades 15-22 mm. broad14. *D. pittosporoides*.
- Carpels (in fruit) 1-3; seeds 15-24; petals in staminate flowers 5.5-7 mm. long; leaf-blades (4-)6-13 mm. broad15. *D. Brassii*.
- Petals 5 or more (rarely 4); stamens in staminate flowers 12-30 or more.
- Leaf-blades fistulose, strongly revolute at margins, 1-5 mm. broad; petals 10-12, the outer ones broadest and sepaloid.....16. *D. fistulosa*.
- Leaf-blades more or less flattened, at least 5 mm. broad.
- Flowers large, the petals about 18 mm. long and 7 mm. broad; stamens in staminate flowers about 30, the carpel solitary17. *D. elongata*.
- Flowers smaller, the petals less than 10 mm. long.
- Petals 10 or more, variable in size, the outer and inner series smaller than the middle series; stamens about 25; leaf-blades 5-10 mm. broad, with obsolete nerves.....18. *D. myrtooides*.
- Petals 7-14; stamens in staminate flowers 19-22; leaf-blades 12-23 mm. broad24. *D. arfakensis*.
- Petals 4-6.
- Leaf-blades obovate, about 2 cm. long and 1 cm. broad, rigidly coriaceous; petals linear-oblong or subspatulate, about 4 mm. long and 2 mm. broad19. *D. parviflora*.
- Leaf-blades elliptic-obovate, 1.5-3 cm. long, 1-2 cm. broad, thick-coriaceous, with reticulate-prominulous nerves; petals oblanceolate or narrowly oblong, 3-5 mm. long, about 2.5 mm. broad20. *D. pachyphylla*.
- Leaf-blades elongate-obovate or oblong-spatulate, 2-4 cm. long, 0.6-1.4 cm. broad, coriaceous; petals narrowly spatulate, 6-8 mm. long, 1.5-2 mm. broad21. *D. Lamii*.
- Large-leaved trees or shrubs, the leaf-blades usually more than 5 cm. long.
- Leaves verticillate, or at least closely aggregated, in clusters of 3-6; petals 7 or 8.
- Pedicels about 1 cm. long; largest petals about 6 mm. long and 1-1.7 mm. broad; leaf-blades attenuate at base22. *D. verticillata*.
- Pedicels 6-7 cm. long; largest petals about 14 mm. long and 5 mm. broad; leaf-blades broadly rounded at base23. *D. rosea*.
- Leaves alternate or subopposite, not verticillate.
- Petals 5 or more (sometimes 4 in no. 25).
- Flowers small, the petals 4-6 mm. long at anthesis, the stamens in staminate flowers usually 15-22.
- Petals 7-14; leaf-blades obovate-lanceolate, up to 6 cm. long and 2.3 cm. broad24. *D. arfakensis*.
- Petals 4-6; leaf-blades narrowly oblanceolate-oblong, 6-10 cm. long, 1.3-2.5 cm. broad25. *D. reticulata*.
- Flowers larger, the petals 6-14 mm. long at anthesis, the stamens in staminate flowers 25-65 (or rarely more).
- Leaves sessile, whitish beneath, the secondary nerves about 7 pairs; flowers large, the petals in staminate flowers 8 or 9, about 10 mm. long.26. *D. grandiflora*.
- Leaves petiolate (petioles at least 3 mm. long), slightly paler beneath or concolorous.
- Secondary nerves and veinlets sharply insculpted above; sepals 8-10 mm. long and broad; petals 5-7 in staminate flowers, 10-14 mm. long27. *D. macrantha*.
- Secondary nerves and veinlets prominulous on both surfaces, rarely slightly impressed above; sepals 3-6.5 mm. long and broad (rarely to 8 mm.); petals 6-8 (-11) in staminate flowers, usually 6-12 mm. long28. *D. piperita*.
- Petals 2-4.
- Leaf-blades narrow, 1-2.2 cm. broad, 4-8 cm. long, the veinlet-reticulation prominulous on both surfaces.

- Apex of leaf-blades abruptly long-acuminate, the texture pergamentaceous; pedicels 3-4 cm. long29. *D. acutifolia*.
- Apex of leaf-blades obtusish, the texture coriaceous; pedicels 1.8-2 cm. long30. *D. Beccariana*.
- Apex of leaf-blades acuminate, the texture coriaceous; pedicels 1.5-1.7 cm. long31. *D. cyclophum*.
- Leaf-blades broader, usually more than 3 cm. broad and 10 cm. long.
- Leaf-blades obtuse and auriculate at base32. *D. densifolia*.
- Leaf-blades gradually narrowed to base and decurrent on the petiole.
- Veinlet-reticulation of the leaf-blades only faintly prominulous, sometimes obsolete above, the costa raised above; stamens in staminate flowers 35-5533. *D. obovata*.
- Veinlet-reticulation of the leaf-blades conspicuously prominulous, at least beneath; stamens in staminate flowers fewer than 35.
- Leaf-blades chartaceous, the costa nearly plane or slightly impressed above; branchlets 2-4 mm. in diameter toward apex; pedicels 7-25 mm. long34. *D. hatamensis*.
- Leaf-blades rigidly coriaceous, the costa impressed above; branchlets not more than 4 mm. in diameter toward apex; pedicels 30-35 mm. long35. *D. dictyophlebia*.
- Leaf-blades thick-coriaceous, the nerves impressed on the upper surface; branchlets about 7 mm. in diameter toward apex; pedicels to 30 mm. long36. *D. coriacea*.

7. ***Drimys vaccinioides*** Ridley in Trans. Linn. Soc. II. Bot. **9**: 13. *pl. 1, f. 1-6*. 1916.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, made by Kloss on the Wollaston Expedition at an altitude of about 3180 m. on Mt. Carstensz.

This species and the following are sharply characterized by their small-leaved epiphytic habit and small flowers; they are quite unmistakable among the New Guinean *Drimytes*. Differences between the two species are chiefly of degree, but the fact that *D. vaccinioides* has 2 petals and *D. microphylla* 4-6 petals seems to indicate that they are not conspecific.

8. ***Drimys microphylla*** A. C. Sm. in Jour. Arnold Arb. **23**: 418. 1942. FIG. 3, f-i.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, Brass 12006 (A), from the Idenburg River region at 1800 m.

9. ***Drimys buxifolia*** Ridley in Trans. Linn. Soc. II. Bot. **9**: 13. 1916; A. C. Sm. in Jour. Arnold Arb. **23**: 419. 1942.

Drimys hatamensis sensu F. v. Muell. in Trans. Roy. Soc. Vict. **1**(2): 1. 1889; non Becc.

DISTRIBUTION: Netherlands and British New Guinea, known from the type collection (Kloss, Mt. Carstensz) and Brass 4239, 4322, and 4602 (all A, NY) from the Central Division, British New Guinea; also collected by MacGregor (ex F. v. Muell.); alt. 2500-3680 m.

I discussed the variation in this species in 1942 and expressed doubt of the specific status of the two following entities, having seen authentic material of neither of them.

10. ***Drimys Versteegii*** Diels in Nova Guin. Bot. **14**: 77. 1924.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, "Hubrecht-Gruppe, auf offenem Gelände, bei 3100 m. ü. M. (Versteeg apud Pulle n. 2412 . . .)."

11. ***Drimys reducta*** Diels in Nova Guin. Bot. **14**: 77. 1924.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, "Gipfel des Wichmann-Berges, 3000 m . . . (Pulle n. 976)."

Diels has noted the close relationship of this species and the preceding to *D. buxifolia* Ridley. From a comparison of the original descriptions of the three entities, it is difficult to point out characters which will serve to separate them.

12. *Drimys oligandra* A. C. Sm. in Jour. Arnold Arb. **23**: 420. 1942.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, *Brass* 12975 (A), from the Idenburg River region at 1300 m.

13. *Drimys rubiginosa* A. C. Sm. in Jour. Arnold Arb. **23**: 420. 1942.

DISTRIBUTION: Netherlands New Guinea, known from the type collection, *Brass* 12629 (A), from the Idenburg River region at 2150 m. Probably also represented by *Brass* 9104 (A) from Lake Habbema, 3225 m.

14. *Drimys pittosporoides* Diels in Nova Guin. Bot. **14**: 76. 1924.

DISTRIBUTION: Netherlands New Guinea, reported only from the type collection, *Lam* 2167, "Central-Gebirge, Fuss des Doorman-Gipfels, 3250 m. ü. M. . . ."

This species is known to me only from the original description, from which I conclude that it is closely related only to the following. It is possible that the montane small-leaved species of New Guinea will prove to be less stable than supposed when ample material is available, at which time the specific lines will need reconsideration.

15. *Drimys Brassii* A. C. Sm. in Jour. Arnold Arb. **23**: 421. 1942. FIG. 3, o, p.

DISTRIBUTION: Netherlands New Guinea, in the Lake Habbema and Mt. Wilhelmina region, alt. 3000–3800 m. Represented by *Brass* 9068 (TYPE), 9536, 10671, *Brass & Myer-Drees* 10126, 10303 (all A), and probably also by *Brass & Myer-Drees* 10111 and 10309 (both A).

16. *Drimys fistulosa* Diels in Nova Guin. Bot. **14**: 78. 1924.

DISTRIBUTION: Netherlands New Guinea, reported from two collections, *Lam* 1615 and 1653, "Central-Gebirge, unterhalb des Doorman-Gipfels," alt. 3250–3500 m.

From the original description this appears to be a very distinct species, characterized by its very narrow revolute-margined leaf-blades and its numerous petals of diverse sizes.

17. *Drimys elongata* Ridley in Hook. Ic. Pl. **31**: pl. 3051. 1916, in Trans. Linn. Soc. II. Bot. **9**: 12. 1916.

DISTRIBUTION: Netherlands New Guinea, reported only from the collection of Kloss on Mt. Carstensz, alt. 750–1650 m. In the second publication cited it is implied that the species is represented by two collections, both apparently unnumbered.

Drimys elongata appears to be a well-marked species, by virtue of its large flowers and elongate pedicels. Its relationship is presumably with the following.

18. *Drimys myrtoides* Diels in Bot. Jahrb. **54**: 241. 1916.

DISTRIBUTION: Northeastern New Guinea, reported from several collections (by Ledermann, Schlechter, and Schultze Jena) from the Sepik region and the Torricelli Mts., at altitudes of 800–2070 m. The type collection is *Ledermann* 12877.

Drimys myrtoides is said to be characterized by its epiphytic small-leaved habit and its numerous petals of diverse sizes. One would anticipate the discovery of this species in the neighboring part of Netherlands New Guinea, but I feel reasonably sure that it is not represented in the collections of the Archbold Expeditions.

Diels has also proposed a variety *gracilis* (in Bot. Jahrb. **54**: 242. 1916), based on *Ledermann* 8430 (type coll.) and 11424, from the Sepik region at 1050 m.; it is said to be more slender ("zierlicher") in all parts than the typical form of the species.

19. ***Drimys parviflora*** Ridley in Trans. Linn. Soc. II. Bot. **9**: 12. 1916.

Bubbia parviflora Burt in Hook. Ic. Pl. **34**: sub pl. 3315. 1936.

DISTRIBUTION: Netherlands New Guinea, recorded only from the type collection, Kloss, Mt. Carstensz, alt. about 2500–3330 m.

Burt has transferred Ridley's species to *Bubbia* without comment, but the original description contains no suggestion that a species of *Bubbia* is represented. The facts that the leaves are very small (2 by 1 cm.) and that the sepals are 2 and connate seem to indicate the place of the plant in *Drimys*. However, Burt has doubtless seen the specimen and has a good reason for his transfer; if this is correct, Ridley's description must be quite inaccurate. For the time being I treat the species on the basis of its original description, which leads me to believe that it is a close relative of the two following.

20. ***Drimys pachyphylla*** Diels in Nova Guin. Bot. **14**: 78. 1924.

DISTRIBUTION: Netherlands New Guinea, "Central-Gebirge, am Doorman-Gipfel, 3260 m. ü. M.," *Lam* 1812. Probably also *Lam* 1707 from the same locality and altitude.

21. ***Drimys Lamii*** Diels in Nova Guin. Bot. **14**: 77. 1924.

DISTRIBUTION: Netherlands New Guinea, "Unterhalb des Doorman-Gipfels, an offenen Stellen oberhalb der Waldgrenze, 2900 m.," *Lam* 1871; also *Lam* 1928, same locality, alt. 2480 m.

22. ***Drimys verticillata*** Pulle in Nova Guin. Bot. **8**: 633. 1912; Diels in Nova Guin. Bot. **14**: 78. 1924.

DISTRIBUTION: Netherlands New Guinea, "auf dem Gipfel des Hellwig-Gebirges in c. 2000 m. ü. M.," *von Römer* 1214 and 1318 (ex Pulle); same locality, alt. 1800–2600 m., *Pulle* 585, 734, 735, 918 (ex Diels).

According to the descriptions, this species and the following seem well distinguished by having their leaves at least pseudoverticillate; Diels remarks that the leaves of *D. verticillata* are not strictly in whorls.

23. ***Drimys rosea*** Ridley in Trans. Linn. Soc. II. Bot. **9**: 11. 1916.

DISTRIBUTION: Netherlands New Guinea, recorded only from the type collection, made by Kloss on Mt. Carstensz, alt. about 3030 m.

24. ***Drimys arfakensis*** Gibbs, Phyt. Fl. Arfak Mts. 135. 1917; A. C. Sm. in Jour. Arnold Arb. **23**: 423. 1942.

DISTRIBUTION: Netherlands New Guinea, Arfak Mts., alt. 1800–2400 m., known from Gibbs 5533, the type, and Kanehira & Hatusima 13408 (A).

Not having seen the type collection, I am not certain of the identity of the Kanehira & Hatusima plant, which differs from the description as noted in 1942. Although Gibbs states that the flowers of her specimen are staminate, the fact that she mentions the ovules and does not describe the stamens leads me to believe that she saw only pistillate flowers. The species has small flowers and comparatively small leaves, but its affinities seem to be with my large-leaved group, as indicated in my key to species.

25. *Drimys reticulata* Diels in Bot. Jahrb. **54**: 242. 1916; A. C. Sm. in Jour. Arnold Arb. **23**: 423. 1942.

DISTRIBUTION: Northeastern New Guinea, Sepik region, alt. 1400–1500 m. (*Leder-mann* 12433, type coll.), and the adjacent Idenburg River region of Netherlands New Guinea (*Brass* 11857, 12149, 12494 [all A]), alt. 1800–2150 m.

26. *Drimys grandiflora* Ridley in Trans. Linn. Soc. II. Bot. **9**: 11. 1916.

DISTRIBUTION: Netherlands New Guinea, reported only from the type collection, made by Kloss on Mt. Carstensz, alt. about 3200 m.

27. *Drimys macrantha* A. C. Sm. in Jour. Arnold Arb. **23**: 422. 1942.

DISTRIBUTION: British New Guinea, known only from *Brass* 4519 (A, TYPE, NY), Wharton Range, Central Division, alt. 2840 m.

28. *Drimys piperita* Hook. f. in Hook. Ic. Pl. **9**: pl. 896. 1852; Becc. Malesia **1**: 185. 1877; Stapf in Trans. Linn. Soc. II. Bot. **4**: 128. 1894; Parment. in Bull. Sci. Fr. & Belg. **27**: 227, 302. 1896; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Merr. in Philip. Jour. Sci. **1**: Suppl. 53. 1906, in Philip. Jour. Sci. Bot. **2**: 272. 1907; Merrill & Merritt in Philip. Jour. Sci. Bot. **5**: 349. 1910; Merr. Enum. Philip. Fl. Pl. **2**: 154. 1923.

Tasmannia piperita Miers in Ann. Mag. Nat. Hist. III. **2**: 110. 1858, Contrib. Bot. **1**: 140. 1861.

Drimys reticulata F. v. Muell. Pl. Indig. Col. Vict. **1**: 21, sphalm for *D. piperita*. 1860.

Dioecious shrub or small tree, up to 4 m. high or more, the branchlets subterete, striate-rugulose, 2–5 mm. in diameter near apices, dark brown or purplish, sometimes glaucous when young; leaves scattered along branchlets, the petioles rugulose, shallowly canaliculate, often narrowly winged, (5–)7–14 mm. long, usually stout, (0.5–)1–2 mm. in diameter; leaf-blades coriaceous or thin-coriaceous, often papyraceous or submembranaceous when young, dark brown or dark olivaceous when dried, often glaucous beneath and frequently with a thin wax-like coating (this smooth, dispersed-punctate, sooner or later completely lost), oblong-obovate or narrowly elliptic, (4–)6–17 cm. long, (1.5–)2.5–6(–7) cm. broad, gradually narrowed toward base and decurrent on the petiole, obtuse to gradually acuminate at apex, narrowly recurved at margin, the costa shallowly canaliculate or slightly raised and flattened above, prominent beneath, the secondary nerves (6–)10–14 per side, spreading at an angle of 45–65°, sharply raised on both surfaces or sometimes slightly impressed above, copiously anastomosing toward margin, the veinlets forming an intricate and obvious reticulum, usually sharply prominulous on both surfaces, rarely somewhat obscure or slightly impressed above; flowers usually numerous, aggregated around growing point of branchlets, at length pseudolateral, solitary or fasciculate in clusters of 2–4, subtended by bracts, these often numerous, papyraceous, oblong-deltoid, 7–15 mm. long, 3–8 mm. broad, acute, soon caducous, leaving obvious scars; pedicels slender, 10–37 mm. long; staminate flowers: sepals 2, submembranaceous, sparsely glandular, broadly elliptic or sub-orbicular, 4–6.5 mm. long, 3.5–6 mm. broad, obtuse or obtusely apiculate at apex; petals 6–8 (rarely to 11), membranaceous, sparsely glandular, oblanceolate, 6–12 mm. long and 1.5–4 mm. broad at anthesis, rounded or obtuse at apex; stamens 25–60, 3–5-seriate, the filaments slightly flattened, eglandular, 1–5 mm. long, the locules oblong-ellipsoid or subglobose, 0.5–1 mm. long, the connective sometimes obscurely glandular at apex; carpels 1–3, sterile, obovoid, 1.5–2 mm. long at anthesis, obtuse at apex, short-

stipitate at base, the stigmatic ridge conspicuous, extending over apex and down the ventral edge nearly to base; pistillate flowers: sepals as in staminate but slightly smaller; petals 5-7, similar to those of staminate flowers but not exceeding 7.5 by 2.5 mm.; stamens none; carpels 2-5, obovoid, 2-2.5 mm. long at anthesis, similar in shape to those of staminate flowers, the ovules 12-30; fruits 1-5-carpellate, the carpels ellipsoid, at maturity 5-15 mm. long and 3-8 mm. broad, obtuse to short-stipitate at base, obtuse or rounded at apex, obviously marked by the stigmatic ridge, the pericarp carnosely, the seeds usually 12-30, castaneous or black, obovoid, slightly or strongly falcate, 2-3 mm. long, 1-1.5 mm. broad, subacute at base, rounded at apex.

DISTRIBUTION: Philippine Islands, Borneo, and Celebes (also reported from Amboina by Beccari), at elevations of 1000-2900 m. (up to 3800 m. on Mt. Kinabalu); usually reported as occurring in mossy-forest and often in exposed situations. The type is from Mt. Kinabalu, Borneo.

PHILIPPINE ISLANDS: Luzon: Ilocos Norte Prov., Mt. Palimlim, *Ramos* 33329 (NY), 33353 (A, GH, UC, US); Benguet Prov., *Loher* 21 (M, NY, US), *Clemens* 17150a (UC); Pauai, *Santos* 32050 (A, UC); Suyoc to Pauai, *Merrill* 4782 (NY, US); Mt. Pulog, *Ramos & Edaño* 44911 (UC); Mt. Pulogloco, *Ramos & Edaño* 40407 (A, UC); Bontoc Prov., *Clemens* 2326 (UC); Mt. Pukis, *Ramos & Edaño* 37822 (A); Mt. Caua, *Ramos & Edaño* 38017 (A, GH); Pauai Benguet to Mt. Data, *Clemens* 7326 (UC); Nueva Vizcaya Prov., Mt. Alzapan, *Ramos & Edaño* 45739 (UC); Nueva Ecija Prov., Mt. Umingan, *Ramos & Edaño* 26297 (A, UC, US); Zambales Prov., *Ramos* 5025 (NY, US); Bataan Prov., Mt. Mariveles and upper Lamao R., *Williams* 745 (NY, US), 754 (GH, NY, US), *Whitford* 149 (NY, US), 1103 (NY, US), *Copeland* 260 (US), *Elmer* 6817 (NY), *Borden* 2093 (NY, US); Rizal Prov., *Loher* 14054 (A), 14060 (UC), 14418 (A), *Angilog*, *Loher* 5511 (US); Mabiluang, *Loher* 14442 (A, UC); Montalban, *Loher* (UC), 12189 (A, UC); Tabayas Prov., Mt. Camatis, *Edaño* 4519 (A), 4964 (A); Mt. Binuang, *Ramos & Edaño* 28572 (A); Mt. Banahao, *Gates* 7192 (F), *Loher* 13678 (A, UC); Laguna Prov., Mt. Banahao, *Ramos* 19583 (NY, US), *Sulit* 30071 (UC), *Loher* 5512 (US); Camarines Sur Prov., Mt. Isarog, *Edaño* 76264 (NY), 76247 (NY); Mindoro: Mt. Halcon, *Merrill* 6134 (NY, US); Leyte: *Wenzel* 778 (A, GH, M, US); Negros: Canlaon Volcano, *Merrill* 248 (US); Dumaguete, Cuernos Mts., *Elmer* 9912 (A, M, NY, US); Mindanao: Bukidnon Prov., Mt. Lipa, *Edaño* 38561 (A, GH, UC); Mt. Candoon, *Ramos & Edaño* 38897 (A), 38905 (A, UC); Agusan Prov., Cabadbaran, Mt. Urdaneta, *Elmer* 13799 (A, F, GH, M, NY, UC, US); Davao Prov., *Kanehira* 2692 (NY); Mt. Apo, *Williams* 2553 (A, NY), *Mearns* (US), *Copeland* 1065 (US), *Elmer* 11410 (M, NY, US), *Clemens* 15609 (UC), 15610 (UC).

BORNEO: British North Borneo: Mt. Kinabalu, *Low* (UC, TYPE COLL.), *Clemens* 10564 (A, UC), 10687 (A), 31670 (A, UC), 31950 (A, UC), 50632 (UC), 50987 (A), *Griswold* 44 (A), 48 (A), 76 (A); Sarawak: Mt. Murud, *Mjoberg* 101 (UC), 102 (UC); Mt. Poi, *Mjoberg* 193 (A, NY, UC); Mt. Dulit, *Richards* 1645 (A), 2507 (A).

CELEBES: Gowa, Lembaja, *Neth. Ind. For. Serv.* 20554 (A, NY); Gowa to Mt. Lompobatang, *Neth. Ind. For. Serv. s. n.* (A).

NATIVE NAMES: In Philippine dialects, as recorded by Merrill, 1923: *Amutútin* (Igorot), *bauang* (Manobo), *inotótan* (Igorot), *lupol* (Bontok), *malagus* (Bagobo).

The above redescription of *D. piperita*, based on abundant material, seems advisable, since the only other descriptions are those of Hooker and Miers, both based entirely on the type collection. This is the only Asiatic species of *Drimys* known to occur outside of New Guinea and Australia. In view of the great diversity of the genus in those regions, it is a striking

contrast to find that the material from the Philippines, Borneo, and Celebes is remarkably constant in its salient characters. I find no basis for the further division of *D. piperita*, although two Philippine specimens not cited above (*Ramos & Edaño* 30731 [A, GH, UC, US], from Mt. Madiass, Panay, and *Elmer* 7747 [A, M, NY, US], from Lucban, Tayabas Prov., Luzon) appear to represent an extreme form. These specimens have unusually large sepals (up to 8 by 7 mm.), as many as 11 petals (whereas no more than 8 were found in the remaining material), which are up to 16 by 5.5 mm., and numerous stamens (up to 100). Since these two specimens are otherwise identical with the bulk of the material, it seems likely that they represent only a local and aberrant form.

The occurrence of *D. piperita* on Amboina is recorded by Beccari, whose determination is very likely correct; however, this station should be verified. It seems possible that the species will also be found on other high islands in the region. Mention of the occurrence of *D. piperita* in New Guinea probably dates from Mueller's record of it in 1889; I believe that Mueller actually had specimens of *D. hatamensis*, for no New Guinean collections referable to *D. piperita* are available to me nor were any cited by Diels.

The relationship of *D. piperita* is with the New Guinean species with large leaves and 5 or more petals, especially *D. macrantha* and *D. grandiflora*, and to a lesser extent *D. arfakensis* and *D. reticulata*. Of these New Guinean species, only *D. macrantha* is sufficiently similar to *D. piperita* to cause any doubt of its specific status; for the time being I believe that these two species are amply distinguished, but it must be kept in mind that the interior of New Guinea is still largely unknown and that future collections may cause students to extend the range of *D. piperita* to that island.

Collectors of material of *D. piperita* have indicated that the petals are white, the stamens yellow, and the fruit at first red, finally black, with a deep purple bitter juice.

29. ***Drimys acutifolia*** Pulle in Nova Guin. Bot. **8**: 633. 1912; Diels in Nova Guin. Bot. **14**: 76. 1924.

DISTRIBUTION: Netherlands New Guinea, "Vorgebirge des Hellwig-Gebirges (Erica-Gipfel) in c. 1400 m. ü. d. M.," *von Römer* 1044 and 1045 (ex Pulle); "Perameles-Gebirge, 1100 m. ü. M.," *Pulle* 482 and 483 (ex Diels).

This species and the two following, according to the descriptions, appear to differ from each other in minor characters only. A comparison of the various collections is highly desirable.

30. ***Drimys Beccariana*** Gibbs, Phyt. Fl. Arfak Mts. 133. f. 9. 1917; Diels in Nova Guin. Bot. **14**: 75. 1924.

DISTRIBUTION: Netherlands New Guinea, reported only from the Arfak Mts. as represented by *Gibbs* 5651 (type coll.) and *Gjellerup* 1204, alt. 2500-2700 m.

31. ***Drimys cyclopus*** Diels in Nova Guin. Bot. **14**: 76. 1924.

DISTRIBUTION: Netherlands New Guinea, apparently known only from the type collection, *Gjellerup* 549, from the Cyclops Mts., alt. 1800 m.

Reports of this species from British New Guinea are referred to *D. hatamensis* Becc.

32. *Drimys densifolia* Ridley in Trans. Linn. Soc. II. Bot. **9**: 12. 1916.

DISTRIBUTION: Netherlands New Guinea, recorded only from the type collection, made by Kloss on Mt. Carstensz, alt. about 3175–3330 m.

This species is presumably amply differentiated from its allies by having its leaf-blades obtuse and auriculate at base, somewhat like those of the Australian *D. insipida* (R. Br.) Pilger, which in other respects is not a very close relative of *D. densifolia*.

33. *Drimys obovata* A. C. Sm. in Jour. Arnold Arb. **23**: 424. 1942. FIG. 3, j-n.

DISTRIBUTION: Netherlands New Guinea, vicinity of Lake Habbema and the Bele River, alt. 2200–2800 m., represented by *Brass* 10567, 10570, 11295 (TYPE), and 11312 (all A).

34. *Drimys hatamensis* Becc. Malesia **1**: 185. 1877; Parment. in Bull. Sci. Fr. & Belg. **27**: 227, 301. *pl.* 10, *f.* 38. 1896; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Diels in Bot. Jahrb. **54**: 242. 1916; A. C. Sm. in Jour. Arnold Arb. **23**: 425. 1942.

Drimys piperita sensu F. v. Muell. in Trans. Roy. Soc. Vict. **1**(2): 1. 1889; non Hook. f.

Drimys cyclopum sensu Lane-Poole, Rep. For. Res. Papua 86. 1925; White & Francis in Proc. Roy. Soc. Queensl. **38**: 228. 1927; non Diels.

DISTRIBUTION: Netherlands, Northeastern, and British New Guinea. The type is a Beccari collection from the Arfak Mts. at 2000 m.; also from the Arfak Mts. are *Kanehira* & *Hatusima* 13785 and 13935 (both A). For the probable occurrence of this species elsewhere in New Guinea and discussions of its status, see Diels in 1916 and my notes in 1942.

35. *Drimys dictyophlebia* Diels in Nova Guin. Bot. **14**: 75. 1924.

DISTRIBUTION: Netherlands New Guinea, represented by the type collection, *Pulle* 845, from the Hellwig Mts. at 1900 m., and probably also by *Brass* 13704 (A), from the Idenburg River region at 700 m.

36. *Drimys coriacea* Pulle in Nova Guin. Bot. **8**: 634. 1912; Diels in Nova Guin. Bot. **14**: 75. 1924.

DISTRIBUTION: Netherlands New Guinea, Hellwig Mts., alt. 2000–2600 m., *von Römer* 1209, 1281 (ex *Pulle*), *Pulle* 577, 595, 958, 959 (ex Diels).

According to the original description, this species is amply characterized by its thick-coriaceous leaves and very stout branchlets.

OLD WORLD SPECIES OF DRIMYS EXCLUDED FROM THE GENUS

Many workers in this group have accepted *Drimys* in a very broad sense, taking its limits to be essentially those of the family. Therefore, practically all of the early species were first described in *Drimys*; these binomials are referred to the appropriate species of the other five genera in the following pages. The species listed immediately below, however, should apparently be removed from the family altogether.

DRIMYS MUELLERI Parment. in Bull. Sci. Fr. & Belg. **27**: 227, 300. *pl.* 10, *f.* 36, 37, *nomen subnudum*. 1896; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 83. 1937.

Drimys intermedia Parment. in Bull. Sci. Fr. & Belg. **27**: 223, 224, sphalm for *D. Muelleri*. 1896; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 83. 1937.

The secondary wood of this species does not suggest a species of *Drimys*, as pointed out by van Tieghem (6: 284).

DRIMYS OBLONGA S. Moore in Jour. Bot. **55**: 302. 1917 = *Hypsophila Halleyana* F. v. Muell. (Celastraceae), according to Dandy in Jour. Bot. **71**: 45. 1933.

2. BUBBIA

Bubbia v. Tiegh. in Jour. de Bot. **14**: 278, 293, 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108, 1906; Hutchinson in Kew Bull. **1921**: 190, 1921; Dandy in Jour. Bot. **72**: 40, 1934; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 83, 1937.

Bubbia Sect. *Eububbia* v. Tiegh. in Jour. de Bot. **14**: 294, 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109, 1906.

Bubbia Sect. *Monoclada* v. Tiegh. in Jour. de Bot. **14**: 294, 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109, 1906.

Bubbia Sect. *Diploclada* v. Tiegh. in Jour. de Bot. **14**: 294, 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109, 1906.

Tetralthalamus Lauterb. in K. Schum. & Lauterb. Fl. Deutsch. Schutzg. Südsee Nachtr. 319, 1905; Engl. in E. & P. Nat. Pfl. ed. 2. **21**: 229, 1925.

Bubbia is here interpreted to include 30 species, which are distributed eight in New Caledonia, one in Lord Howe Island, two in Queensland, and nineteen in New Guinea. The first species referable to the group was described in 1869 by Mueller (*Drimys Howeana*) and this is also the genotype. The genus is readily separated from *Drimys* on characters pertaining to the calyx, from *Zygogynum* by its separate carpels, from *Pseudowintera* by its terminal inflorescence, from *Bellium* by its stamens, and from *Exospermum* by its placentation and free carpels (which are rarely appressed-contiguous in young flowers). In many respects *Bubbia* appears to have retained the hypothetical primitive characters of the family better than the other genera, although its carpellary characters are diverse and probably more highly evolved than those of *Drimys* Sect. *Tasmannia*.

Van Tieghem's three sections are based on the greater or lesser degree of branching of the primary rays of the inflorescence, a character which appears of no more than specific value. I find it impossible to propose sectional segregations within the genus, as the inter-relationships of the various species are highly complex. Possibly a classification may eventually be based upon characters of the carpel, such as the position and extent of the stigmatic ridge and the extent of placental areas. The key to the New Guinean species proposed below is entirely artificial.

SPECIES OF NEW CALEDONIA AND LORD HOWE ISLAND

On the basis of herbarium material available in America, it is impossible properly to evaluate the eight species of *Bubbia* reported from New Caledonia and the species from Lord Howe Island. The original descriptions of these species are for the most part inadequate, and a consideration of their status must await examination of the collections in the herbaria at Paris and the British Museum. However, a few brief notes on these entities are given below, in order to bring together references to literature. For lack of a better method, I discuss the names in chronological order.

1. **Bubbia Howeana** (F. v. Muell.) v. Tiegh. in Jour. de Bot. **14**: 293, 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109, 1906; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 84, 1937.

Drimys Howeana F. v. Muell. Fragm. Phyt. Austral. **7**: 17, 1869; Parment. in Bull. Sci. Fr. & Belg. **27**: 230, 307, 1896.

Drimys insularis Baill. ex F. v. Muell. Fragm. Phyt. Austral. **9**: 76, *nomen*. 1875; Parment. in Bull. Sci. Fr. & Belg. **27**: 230, 307, as synonym. 1896.

Bubbia Muelleri v. Tiegh. in Jour. de Bot. **14**: 293, *nomen*. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109, *nomen*. 1906.

DISTRIBUTION: Lord Howe Island; type collected by C. Moore.

I have seen no material of *Bubbia* from Lord Howe Island, and the original description of *Drimys Howeana* by Mueller does not permit the accurate placing of the species, although its generic identity is beyond doubt. This species was selected by van Tieghem as the type of *Bubbia*. *Drimys insularis* has never been adequately described, and I do not question Vickery's reference (7: 84) of it to synonymy under *Bubbia Howeana*. *Bubbia Muelleri* was named, but not described, by van Tieghem on the basis of Mueller's discussion (Fragm. Phyt. Austral. **7**: 17. 1869) of a second plant from Lord Howe Island, known in fruit only and said by Mueller to be perhaps conspecific with *Drimys Howeana*. The name *Bubbia Muelleri* has no status of consequence, and until collections offer proof to the contrary, one may assume that there is only one species of *Bubbia* on Lord Howe Island.

2. *Bubbia Balansae* (Baill.) v. Tiegh. in Jour. de Bot. **14**: 293. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Drimys Balansae Baill. in Adansonia **10**: 335. 1873; Guillaumin in Ann. Mus. Col. Marseille II. **9**: 95. 1911.

DISTRIBUTION: New Caledonia, apparently known only from the type collection, Balansa 1844, from Mt. Humboldt, alt. 1100 m.

Van Tieghem (6: 294) proposes his Sect. *Monoclada* on this species alone. The species is said to be characterized by its very small leaves and flowers and the small number of its inflorescence-rays, each of which bears only two flowers at its summit.

3. *Bubbia Deplanchei* v. Tiegh. in Jour. de Bot. **14**: 293. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Drimys Deplanchei Vieill. ex v. Tiegh., l. c., as synonym.

DISTRIBUTION: New Caledonia, thus far reported only from the type collection, Vieillard 2279, from Wagape.

This species is briefly characterized by van Tieghem as having its flowers arranged in a simple umbel; it was the only species of the genus known to him with this character and he placed it alone in his Sect. *Eububbia*. This choice of a sectional name is unfortunate, since elsewhere (6: 278) van Tieghem clearly states that the type-species of the genus *Bubbia* is *B. Howeana*.

4. *Bubbia auriculata* v. Tiegh. in Jour. de Bot. **14**: 293. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; A. C. Sm. in Jour. Arnold Arb. **23**: 438. 1942.

Drimys amplexicaulis Vieill. ex Parment. in Bull. Sci. Fr. & Belg. **27**: 231, 308. *pl.* 10, f. 34, *nomen subnudum*. 1896; Vieill. ex v. Tiegh. in Jour. de Bot. **14**: 293, as synonym. 1900; Bak. f. in Jour. Linn. Soc. Bot. **45**: 267. 1921.

Bubbia amplexicaulis Dandy in Jour. Bot. **72**: 40. 1934; Burt in Hook. Ic. Pl. **34**: sub *pl.* 3315. 1936.

DISTRIBUTION: New Caledonia, reported from the type collection, Vieillard 2280 (GH) from Wagape, and also from Compton 1551 (ex Bak. f.) or 1581 (ex Dandy) from Ignambi.

This is one of the species which Burt (1) believes to weaken the generic

distinctions between *Bubbia* and *Belliolum*. I have recently (3: 438) discussed the points raised by him and also questioned Dandy's acceptance of Parmentier's specific epithet. *Bubbia auriculata* is readily distinguished by its long narrow sessile leaf-blades with auriculate subamplexicaul bases.

5. *Bubbia heteroneura* v. Tiegh. in Jour. de Bot. **14**: 294. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Drimys heteroneura v. Tiegh. ex Bak. f. in Jour. Linn. Soc. Bot. **45**: 267. 1921.

DISTRIBUTION: New Caledonia, recorded by van Tieghem from Vieillard 20 (type coll.) and Deplanche 293, both from Pucop; doubtfully reported by Baker from Compton 1130 from Mt. Canala.

Van Tieghem's description is very inadequate, but, since he mentions a few details of the leaf and cites specimens, the publication must be considered valid.

6. *Bubbia isoneura* v. Tiegh. in Jour. de Bot. **14**: 294. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

DISTRIBUTION: New Caledonia, reported only from the type collection, Vieillard 17 (GH), from Wagape.

From the original brief descriptions of the two species, this and *B. heteroneura* appear to be weakly differentiated. Burt (1) has reduced *B. isoneura* to *Bubbia crassifolia* (i.e. *Belliolum crassifolium*). The available type duplicate of *Bubbia isoneura* bears very young fruiting carpels, in which the ovules are aggregated in two closely appressed rows corresponding to the obliquely ventral stigmatic ridge. In this character, therefore, the plant would appear to be properly placed in *Bubbia*, although verification from staminal characters is desirable. In the carpels of *Belliolum crassifolium*, as represented by Schlechter 15348, the ovules are in two rows which are slightly removed laterally from the ventral suture of the carpel. This tendency is probably characteristic of *Belliolum*, to which, on the basis of its stamens, Schlechter 15348 belongs. The two specimens under discussion show slight intangible differences in foliage; on the basis of the evidence now available I cannot agree with Burt's reduction, and therefore I list *Bubbia isoneura* as an independent species.

7. *Bubbia Comptonii* (Bak. f.) Dandy in Jour. Bot. **72**: 41. 1934.

Drimys Comptonii Bak. f. in Jour. Linn. Soc. Bot. **45**: 267. 1921.

DISTRIBUTION: New Caledonia, reported only from the type collection, Compton 1815, from Mt. Panié, alt. 750-1200 m.

In describing three new species of this complex from New Caledonia, Baker, although his descriptions are fairly complete, omits the staminal details which are necessary to distinguish species of *Bubbia* from those of *Belliolum*. In transferring the specific epithets to *Bubbia*, Dandy has doubtless considered this point and has found that Baker's species belong in *Bubbia* in van Tieghem's original sense, not as later expanded by Burt. It is significant that Baker does not compare any of his three species with any of van Tieghem's; consequently one should see type material of all the New Caledonian species before reaching conclusions as to their specific status.

According to the original description, *B. Comptonii* is characterized by having its stamens often reduced to 3 and its carpel usually solitary.

8. *Bubbia odorata* (Bak. f.) Dandy in Jour. Bot. **72**: 41. 1934.

Drimys odorata Bak. f. in Jour. Linn. Soc. Bot. **45**: 268. 1921.

DISTRIBUTION: New Caledonia, reported only from the type collection, *Compton* 1982 (ex Baker) or 1983 (ex Dandy), from Tonine, alt. above 750 m.

Baker remarks, "The noticeable features of this species are the oblanceolate glabrous leaves with a thick midrib, the flowers with a strong sweet scent, the petals being white with a purple patch towards the base, the generally 5 stamens and 2 carpels."

9. *Bubbia pauciflora* (Bak. f.) Dandy in Jour. Bot. **72**: 41. 1934.

Drimys pauciflora Bak. f. in Jour. Linn. Soc. Bot. **45**: 268. 1921.

DISTRIBUTION: New Caledonia, reported only from the type collection, *Compton* 1761 (ex Baker) or 1768 (ex Dandy), from Mt. Panié, alt. about 450 m.

Baker remarks, "Easily distinguished by the slender leaves much attenuate below, with very slender indistinct lateral nerves, the few flowers on long pedicels, and generally 3 carpels."

AUSTRALIAN SPECIES

The genus *Bubbia* apparently has a very limited range in Australia, thus far being known only from eastern Queensland approximately between latitudes 16° and 18°. To the single species previously reported from this region, *B. semecarpoides*, I here add a second, which is probably a montane derivative from a common ancestor. The two species are essentially similar in fundamental details, but I believe that the points brought out in the following key are of specific value. The specimen from Bellenden Ker which Domin refers to *Drimys semecarpoides* should be re-examined in comparison with my new species. As the descriptions of Mueller and Bailey are incomplete, I have redescribed *B. semecarpoides* from more recent material.

The two Australian species do not show a close affinity to any of the New Guinean species, having floral characters somewhat resembling those of *B. oligocarpa* (Schlecht.) Burt and its allies, but in foliage they are more suggestive of some of the New Caledonian species.

KEY TO THE AUSTRALIAN SPECIES

- Petioles stout, 2-3 mm. in diameter, 15-27 mm. long; leaf-blades 12-20 cm. long, 3-7 cm. broad, the costa impressed above; inflorescence compound, the primary rays 2- or 3-flowered; stamens 25-32; carpels 5-8 per flower, the ovules 10-16; seeds usually 10-12 at maturity10. *B. semecarpoides*.
 Petioles slender, 1-1.5 mm. in diameter, 5-20 mm. long; leaf-blades 6-12 cm. long, 1.5-4.5 cm. broad, the costa subplane above; inflorescence simple, the flowers rarely paired on short peduncles; stamens 18 or 19; carpels 3 or 4 per flower, the ovules 7-10; seeds 3-6 at maturity11. *B. Whiteana*.

10. *Bubbia semecarpoides* (F. v. Muell.) Burt in Hook. Ic. Pl. **34**: sub pl. 3315. 1936.

Drimys semecarpoides F. v. Muell. in Vict. Nat. **8**: 15. 1891, in Bot. Centralbl. **46**: 204. 1891; F. M. Bailey, Queensl. Fl. **1**: 19. 1899, Compr. Cat. Queensl. Pl. 21. 1913; Domin in Bibl. Bot. **22**[Heft 89]: 115. 1925.

Tree to 20 m. high, the branchlets stout (4-7 mm. in diameter toward apices), subterete, brownish or cinereous; leaves aggregated toward apices of branchlets, the petioles rugulose, semiterete, 15-27 mm. long, stout (2-3

mm. in diameter), the leaf-blades subcoriaceous or chartaceous, dark olivaceous or brownish when dried, concolorous or conspicuously glaucous beneath, oblong- or elliptic-obovate, 12–20 cm. long, 3–7 cm. broad, gradually narrowed to an attenuate base and decurrent on the petiole, rounded or broadly obtuse at apex, narrowly recurved at margin, especially toward base, finely rugulose on both surfaces, the costa impressed above, prominent beneath, the secondary nerves 10–18 per side, erecto-patent at an angle of $45\text{--}60^\circ$, obscurely anastomosing toward margin, slightly prominulous on both surfaces or nearly obscure, the veinlets immersed; inflorescence pseudoterminal, sessile, the primary rays apparently about 4, 2.5–8 cm. long including flowers or fruits, once- or rarely twice-branched, 2- or 3-flowered, granular-papillose, the bracts and bracteoles soon caducous, the pedicels 3–5 mm. long before anthesis, up to 15 mm. long in fruit; calyx papyraceous, rotate, deeply 2–4-lobed, the lobes sparsely glandular, ovate-deltoid, 2–3 mm. long and broad, obtuse; petals immature in our specimen (coll. White) but apparently several, carnosae; stamens 25–32, 2- or 3-seriate, up to 1.3 mm. long (immature), the filaments subcarnose, flattened, broadened distally, sparsely yellow-glandular, the locules apical, obliquely horizontal, 0.3–0.5 mm. long; carpels 5–8, obovoid, 1.5–2 mm. long slightly before anthesis, contracted toward base, the stigmatic ridge subapical, 0.3–0.6 mm. long, the ovules 10–16, on short ventral-apical placentas; carpels in fruit 5–8, usually 3 or 4 maturing, the others abortive, occasionally only 1 maturing; mature carpels obovoid, up to 12 mm. long (excl. stipe) and 10 mm. broad, the basal stipe stout, about 2 mm. thick and long, the apex rounded, the stigmatic ridge inconspicuous, subapical; pericarp coriaceous, 1–1.5 mm. thick, obscurely rugulose without; seeds usually 10–12 at maturity, closely appressed, oblong-obovoid, slightly falcate, about 5 mm. long and 2.5 mm. thick, subacute at base, rounded at apex.

DISTRIBUTION: Northeastern Queensland, apparently limited to the region from the Atherton Tableland to the vicinity of Rockingham Bay, lat. about $17\text{--}18^\circ$, at altitudes up to 700 m. The type was collected by W. Sayer on "Russell's Creek," a locality I have not located on modern maps but which is probably near Rockingham Bay. Other collections from this region which have been cited by Bailey and Domin were made by Dallachy, W. Hill, and Domin, the latter from Bellenden Ker.

AUSTRALIA: Queensland: Boonjie, Atherton Tableland, *White* (A); East Malanda, Atherton Tableland, *Kajewski 1216* (A, NY) (common in rain-forest).

Although I have not seen authentic material of Mueller's species, it is obvious from his original description that he had the large-leaved species described above and not the following.

11. *Bubbia Whiteana* sp. nov. FIG. 4, a-f.

Arbor ad 8 m. alta, ramulis subteretibus brunneis crassis, apicem versus 3–4 mm. diametro; foliis secus ramulos copiose dispersis; petiolis rugulosis semiteretibus 5–20 mm. longis, 1–1.5 mm. diametro; laminis coriaceis siccitate olivaceis, utrinque conspicue rugulosis, subtus plerumque glaucis, elliptico-obovatis, 6–12 cm. longis, 1.5–4.5 cm. latis, basi attenuatis et in petiolum decurrentibus, apice rotundatis vel obtusis, margine recurvatis vel conspicue revolutis, costa supra subplana subtus prominente, nervis secundariis utrinsecus 8–15 obscuris angulo $45\text{--}60^\circ$ a costa abeuntibus, rete venularum immerso; inflorescentia pseudoterminali simplici, floribus 3–6 apicem ramulorum circa dispositis raro pedunculo brevi binis, pedicellis

gracilibus papillosis sub anthesi 8–18 sub fructu ad 25 mm. longis; calyce papyraceo rotato profunde 2- vel 3-lobato, lobis parce glandulosis ovato-deltaideis, 2–2.5 mm. longis, 2.5–4 mm. latis, apice obtusis; petalis 6 vel 7 subcarnosis oblongis vel obovato-oblongis, apice rotundatis vel obtusis, exterioribus sub anthesi 6–6.5 mm. longis et 2.5–3.5 mm. latis, interioribus paullo minoribus; staminibus 18 vel 19, 2-seriatis, sub anthesi 1.5–2 mm.



FIG. 4. *a-f. Bubbia Whiteana*, drawn from the type: *a.* fruiting branchlet, $\times \frac{1}{2}$; *b.* flower, with two petals removed, $\times 2$; *c.* stamens, extorse and introrse views, $\times 5$; *d.* carpel, $\times 5$; *e.* fruit, with one mature carpel, $\times 1$; *f.* seed, $\times 2$. *g-i. Bubbia Clemensiae*, drawn from the type: *g.* inflorescence and leaf, $\times \frac{1}{4}$; *h.* flower, past anthesis, with petals and stamens fallen, $\times 1$; *i.* stamens, introrse and extorse views, $\times 3$. *j-m. Bubbia Archboldiana*, drawn from the type: *j.* flowering branchlet, $\times \frac{1}{4}$; *k.* flower, with two petals removed, $\times 1\frac{1}{2}$; *l.* stamens, extorse and introrse views, $\times 5$; *m.* carpel, $\times 5$.

longis, filamentis complanatis apicem versus incrassatis, loculis apicalibus 0.3–0.5 mm. longis, horizontalibus vel leviter obliquis; carpellis 3 vel 4 obovoideis sub anthesi 1.5–2 mm. longis, basi contractis, carina stigmatum subapicali 0.3–0.5 mm. longa, ovulis 7–10, placentis brevibus ventrali-apicalibus; carpellis fructiferis maturitate 1–3 subglobosis vel obovoideis, 8–11 mm. diametro, basi breviter stipitatis (stipite circiter 2 mm. longo et diametro), apice rotundatis, carina stigmatum obscura brevi subapicali, pericarpio carnoso demum coriaceo 0.5–2 mm. crasso extus obscure ruguloso, seminibus maturitate 3–6 nigris oblongo-obovoideis leviter falcatis, 4.5–5 mm. longis, 2–2.5 mm. crassis, basi obtusis, apice rotundatis.

DISTRIBUTION: Known only from the type locality in northeastern Queensland, lat. about $16^{\circ} 15'$.

AUSTRALIA: Queensland: Thornton Peak (Mt. Alexander), Daintree River

region, alt. 1200–1350 m., *Brass* 2278 (A, TYPE), Mar. 14, 1932 (small tree of the low scrubs near summit; leaves silver-gray beneath, much recurved at margin; flowers yellow, on red pedicels; fruits black), *Kajewski* 1495 (A, NY) (small gnarled tree up to 8 m. high, common in poor scrub on top of mountain; leaves silver beneath; pedicels brown; petals cream-green; fruits black when ripe).

Although the new species is doubtless a close relative of *B. semecarpoides*, I believe that it is worthy of specific rank on the basis of its substantially smaller leaves, simpler inflorescence, and fewer stamens, carpels, ovules, and seeds. The species is named for Dr. C. T. White, of the Botanic Gardens of Brisbane, who has contributed much to our knowledge of Queensland plants.

NEW GUINEAN SPECIES

Bubbia apparently reaches its greatest development in New Guinea, where 19 species are now known. The total variability of the New Guinean population considerably exceeds that of the New Caledonian, as indicated in the extremes of carpel-structure, fruit-size and shape, number and surface of seeds, number of stamens, and types of foliage. Many of the New Guinean species are known from single collections, and some of these I have not seen; therefore the following key is based to a certain extent on descriptions, but in general these are ample. This treatment will need considerable revision when more ample material is available, for it seems certain that additional species will be discovered and that some of the existing ones will need amplification. *Bubbia* is less important than *Drimys* in New Guinea as an element of the vegetation, if one may judge from the existing collections. It occurs at lower elevations, usually between 400 and 2800 m., but sometimes as low as 100 m. and in one species as high as 3600 m. One may assume, from field notes, that the species are usually of scattered occurrence and are never dominant, as are certain species of *Drimys* at high elevations.

KEY TO THE NEW GUINEAN SPECIES

- Leaf-blades comparatively small, 6.5–14 cm. long, 2.5–4.5 cm. broad; inflorescence comparatively few-flowered, the primary rays simple or once- or twice-branched.
 - Lateral nerves of the leaf-blades inconspicuous, prominulous or slightly prominent, the blades not bullate.
 - Inflorescence simple, about 3-flowered; calyx about 3-lobed; petals about 4 mm. long; carpel 1; leaf-blades papyraceous12. *B. Ledermannii*.
 - Inflorescence once- or twice-branched, several-flowered; calyx 5–7-lobed; petals 8–11 mm. long; carpels 3 or 4, adnate at anthesis, at length free; leaf-blades thick-coriaceous13. *B. pachyantha*.
 - Lateral nerves of the leaf-blades strongly prominent beneath and impressed above, the blades bullate and coriaceous14. *B. bullata*.
- Leaf-blades larger, 14–40 cm. long, 5–14 cm. broad, rarely slightly smaller; inflorescence many-flowered, the primary rays 2- or 3-times branched (essentially simple in no. 24).
 - Lateral nerves of the leaf-blades leaving the costa at an angle of 50–70(–75)°.
 - Primary lateral nerves of the leaf-blades 20–40, the blades papyraceous.
.....15. *B. polyneura*.
 - Primary lateral nerves of the leaf-blades 8–20 (about 22 in nos. 20 and 22), the blades coriaceous or chartaceous.

- Flowers large, the petals usually 6 in number, 11–17 mm. long, 5–12 mm. broad; calyx irregularly 6–9-lobed; stamens 100–125, 5- or 6-seriate; primary rays of inflorescence 3 or 416. *B. Clemensiae*.
- Flowers smaller, the petals less than 10 mm. long; calyx 2- or 3-lobed (subentire in no. 18); stamens not more than 35, usually 2- or 3-seriate.
- Petals 5–10; stigma strictly apical, not extending down the ventral edge of the carpel.
- Primary rays of inflorescence 1–4; petals apparently 5–8, probably not exceeding 8 mm. in length and 3.5 mm. in breadth; stamens 12–18.
- Carpels 1 or 2; stamens about 17 or 18 (possibly 10–20); leaf-blades 20–30 cm. long, 7–12 cm. broad.
- Calyx 3-lobed; petals 6 or 7, about 6 mm. long and 3.5 mm. broad; anther-locules obliquely apical-lateral; carpels 2 ..17. *B. oligocarpa*.
- Calyx essentially circular and entire at margin; petals 5, not more than 5 mm. long and 3 mm. broad; anther-locules horizontal; carpel solitary18. *B. monocarpa*.
- Carpels 3 or 4; stamens 12–16, the anther-locules horizontal.
- Leaf-blades 15–18 cm. long, 4–6 cm. broad; petals 8, the outer ones about 3.5 mm. long and 2 mm. broad; stamens about 12; carpels 4, adnate19. *B. montana*.
- Leaf-blades 35–40 cm. long, 9–11 cm. broad, glaucous and farinose-ceriferous beneath; stamens 14–16; carpels 3, free; fruit subglobose, up to 3 cm. in diameter, the seeds conspicuously plicate-rugose20. *B. longifolia*.
- Primary rays of inflorescence 6–8; petals 8–10, the outer ones 8–10 mm. long and about 6 mm. broad; stamens 22–35, the anther-locules horizontal; carpels 3–5, free; leaf-blades 14–22 cm. long, 5–7.5 cm. broad21. *B. sylvestris*.
- Petals 4 or 5 (not known in nos. 23 and 24); stigma apical and also extending at least part of the way down the ventral edge of the carpel.
- Primary lateral nerves of the leaf-blades about 22; flowers small, the petals about 2 mm. long; primary rays of inflorescence 5 or 6; stamens about 20; carpels 3 or 422. *B. umbellata*.
- Primary lateral nerves of the leaf-blades 8–15; flowers larger, the petals probably at least 5 mm. long.
- Petioles (0.8–)1–2 cm. long; stigmatic ridge inconspicuous, apparently occupying less than half of both apical and ventral faces of carpel, 3–5 mm. long in fruit; seeds 2–11; rays of inflorescence 3–6.
- Leaf-blades coriaceous, the veinlets usually immersed; rays of fruiting inflorescence 2- or 3-times branched; carpels 4–623. *B. idenburgensis*.
- Leaf-blades chartaceous, the veinlets usually prominulous on both surfaces; rays of fruiting inflorescence essentially simple or once-branched; carpels probably 2 in flower, often solitary in fruit24. *B. glauca*.
- Petioles usually less than 1 cm. long; stigmatic ridge elongate, occupying most of both apical and ventral faces of carpel.
- Primary rays of inflorescence 6–11; carpels 9 or 10; stigmatic ridge occupying about $\frac{2}{3}$ of both apical and ventral faces of carpel; locule straight, the ovules about 16, biseriate ..25. *B. Archboldiana*.
- Primary rays of inflorescence 3–5; carpel 1; stigmatic ridge extending along entire apical and ventral faces of carpel; locule sharply curved, the ovules 50 or more, several-seriate; fruit to 4 cm. by 5 cm., the seeds numerous26. *B. megacarpa*.
- Lateral nerves of the leaf-blades widely spreading, leaving the costa at an angle of 70–85°; venation conspicuous on both surfaces; stigmatic ridge strictly apical.

- Petioles 1–1.8 cm. long; leaf-blades comparatively narrow, 4–6.5 cm. broad, the primary lateral nerves 15–20 per side; rays of inflorescence 10–13 27. *B. argentea*.
- Petioles longer, 1.5–3 cm. long; leaf-blades broader, 6–14 cm. broad, the primary lateral nerves more than 20; rays of inflorescence apparently less than 8.
- Leaf-blades oblanceolate, 6–10 cm. broad, the primary lateral nerves 25 or fewer per side; petioles 1.5–2.5 cm. long.
- Primary rays of inflorescence stout, to 12 cm. long; stamens 25–30; petals 8–10 mm. long 28. *B. calothyrsa*.
- Primary rays of inflorescence slender, 12–15 cm. long; stamens 12–22; petals 5–7 mm. long 29. *B. sororia*.
- Leaf-blades oblong-elliptic, 10–14 cm. broad, the primary lateral nerves 25–35 per side; petioles about 3 cm. long; primary rays of inflorescence to 15 cm. long 30. *B. calophylla*.

12. **Bubbia Ledermannii** (Diels) Burt in Hook. Ic. Pl. **34**: sub. *pl.* 3315, as *B. Ledermanni*. 1936.

Drimys Ledermannii Diels in Bot. Jahrb. **54**: 243. 1916.

DISTRIBUTION: Northeastern New Guinea, reported from *Ledermann* 8990 (type coll.) and 8973, from the Sepik region, alt. about 850 m.

13. **Bubbia pachyantha** A. C. Sm. in Jour. Arnold Arb. **23**: 428. 1942.

DISTRIBUTION: British New Guinea, known only from the type collection, *Brass* 4371 (A, TYPE, NY), from Mt. Albert Edward, Central Division, alt. 3550–3600 m.

14. **Bubbia bullata** (Diels) A. C. Sm. in Jour. Arnold Arb. **23**: 426. 1942.

Drimys bullata Diels in Bot. Jahrb. **54**: 243. 1916.

DISTRIBUTION: Northeastern New Guinea, known only from the type collection, *Schultze Jena* 342, from the Kaiserin Augusta River region.

15. **Bubbia polyneura** (Diels) Burt in Hook. Ic. Pl. **34**: sub. *pl.* 3315. 1936.

Drimys polyneura Diels in Bot. Jahrb. **54**: 244. 1916.

DISTRIBUTION: Northeastern New Guinea, reported only from the type collection, *Ledermann* 8986, from the Sepik River region, alt. about 850 m.

16. **Bubbia Clemensiae** A. C. Sm. in Jour. Arnold Arb. **23**: 431. 1942. FIG. 4, g-i.

DISTRIBUTION: Northeastern New Guinea, known only from *Clemens* 4596 (A) and 5157 (A, TYPE), from the Morobe District, alt. 1750–1800 m.

17. **Bubbia oligocarpa** (Schlecht.) Burt in Hook. Ic. Pl. **34**: sub *pl.* 3315. 1936.

Drimys oligocarpa Schlecht. in Bot. Jahrb. **50**: 71. f. 1. 1913; Diels in Nova Guin. Bot. **14**: 79. 1924.

DISTRIBUTION: Northeastern and Netherlands New Guinea, reported originally from *Schlechter* 16470 (TYPE COLL., UC), from Wobbe, Northeastern New Guinea, alt. about 400 m., and *Moszkowski* 281, from Taua, Netherlands New Guinea. Diels adds the following records: *Lam* 794, 1165, and 1225, from the Mamberamo region of Netherlands New Guinea, alt. about 200 m.

In keying this species I have relied upon the original description and the type collection, which has about 18 stamens. Diels reports that the *Lam* collections have 10–20 stamens and have leaves which are variable in width. Even including this variation in one's concept, the species remains clearly separable from its closest allies, which are the three following species in this treatment.

18. **Bubbia monocarpa** A. C. Sm. in Jour. Arnold Arb. **23**: 428. 1942.

DISTRIBUTION: Netherlands New Guinea, known only from *Kanekira & Hatusima* 12105 (A, TYPE), from Dalman, inland from Nabire, alt. 400 m.

In this species and its close relatives (nos. 17–21 in my key) the stigmatic ridge is strictly apical and the ovules are pendulous.

19. **Bubbia montana** (Lauterb.) A. C. Sm. in Jour. Arnold Arb. **23**: 426. 1942.

Tetrathalamus montanus Lauterb. in K. Schum. & Lauterb. Fl. Deutsch. Schutzg. Südsee Nachtr. 319. 1905, in Bot. Jahrb. **53**: 15. f. 4. 1922; Engl. in E. & P. Nat. Pfl. ed. 2. **21**: 229. f. 100. 1925; Burt. in Kew Bull. **1938**: 458. 1938.

DISTRIBUTION: Northeastern New Guinea, recorded only from the type collection, *Schlechter* 13984, from the Bisinarck Mts., alt. 1200 m.

The monotypic genus *Tetrathalamus*, originally placed in the Guttiferae, was first referred to the Winteraceae by Burt.

20. **Bubbia longifolia** A. C. Sm. in Jour. Arnold Arb. **23**: 429. 1942.

DISTRIBUTION: Netherlands New Guinea, known only from *Brass* 13868 (A, TYPE), from the Idenburg River, alt. 175 m.

21. **Bubbia sylvestris** A. C. Sm. in Jour. Arnold Arb. **23**: 430. 1942.

DISTRIBUTION: Netherlands New Guinea, Morobe District, alt. 1500–1800 m., known from *Clemens* 4122 (A), 4463 (A), 41142 (A, TYPE), and probably also 5008 (A) and 41800 (A) (alt. 750–1350 m.).

22. **Bubbia umbellata** (Ridley) Dandy in Jour. Bot. **72**: 41. 1934.

Drimys umbellata Ridley in Trans. Linn. Soc. II. Bot. **9**: 11. 1916.

DISTRIBUTION: Netherlands New Guinea, reported only from the type collection, made by Kloss in the Otakwa River region, south of Mt. Carstensz, alt. about 1200 m.

23. **Bubbia idenburgensis** A. C. Sm. in Jour. Arnold Arb. **23**: 432. 1942.

DISTRIBUTION: Netherlands New Guinea, Idenburg River region, alt. 900–1250 m., known from *Brass* 13028 (A, TYPE) and 13313 (A).

24. **Bubbia glauca** A. C. Sm. in Jour. Arnold Arb. **23**: 433. 1942.

DISTRIBUTION: British New Guinea, known only from *Brass* 7191 (A, TYPE), from the upper Fly River region, Western Division, alt. 100 m.

25. **Bubbia Archboldiana** A. C. Sm. in Jour. Arnold Arb. **23**: 433. 1942. FIG. 4, j-m.

DISTRIBUTION: Netherlands New Guinea, known only from *Brass* 12712 (A, TYPE), from the Idenburg River region, alt. 2100 m.

26. **Bubbia megacarpa** A. C. Sm. in Jour. Arnold Arb. **23**: 434. 1942.

DISTRIBUTION: Netherlands New Guinea, known only from *Brass* 10249 (A, TYPE), from the vicinity of Lake Habbema, alt. 2800 m.

27. **Bubbia argentea** A. C. Sm. in Jour. Arnold Arb. **23**: 436. 1942.

DISTRIBUTION: British New Guinea, known only from *Brass* 4740 (A, NY, TYPE), from the Wharton Range, Central Division, alt. 2840 m.

28. **Bubbia calothyrsa** (Diels) A. C. Sm. in Jour. Arnold Arb. **23**: 427. 1942.

Drimys calothyrsa Diels in Bot. Jahrb. **54**: 244. 1916.

DISTRIBUTION: Northeastern New Guinea, reported from *Ledermann* 11028 (type coll.) and 11166, from the Sepik region, alt. 1300–1350 m.; probably also *Ledermann* 12978, from the same region, alt. 1400–1500 m.

29. **Bubbia sororia** (Diels) A. C. Sm. in Jour. Arnold Arb. **23**: 427. 1942.

Drimys sororia Diels in Bot. Jahrb. **54**: 245. 1916.

DISTRIBUTION: Northeastern New Guinea, reported from *Ledermann* 11661, 11898 (type coll.), and 12141, from the Sepik region, alt. 1900–2070 m.

30. **Bubbia calophylla** A. C. Sm. in Jour. Arnold Arb. **23**: 436. 1942.

DISTRIBUTION: Northeastern New Guinea, known only from *Clemens* 5061 (A, TYPE), from the Morobe District, alt. about 1800 m.

3. BELLIOLOUM

Belliolium v. Tiegh. in Jour. de Bot. **14**: 278, 330. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Hutchinson in Kew Bull. **1921**: 190. 1921.

Drimys Sect. *Sarcodrimys* Baill. in Adansonia **8**: 200. 1867, Hist. Pl. **1**: 159, 160. 1867-69.

Belliolium Sect. *Monocladiscum* v. Tiegh. in Jour. de Bot. **14**: 331. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Belliolium Sect. *Di cladiscum* v. Tiegh. in Jour. de Bot. **14**: 331. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Belliolium is thus far known to be represented by eight species, four of which occur in New Caledonia and the remainder in the Solomon Islands. However, several of these species are known in fruiting condition only, and, since the distinction between *Bubbia* and *Belliolium* depends primarily upon staminal characters, there is reason to question the generic disposition of these species. The geographic distribution of *Belliolium* forms a curious contrast to that of *Bubbia*; both genera are known from New Caledonia, but the first is lacking from New Guinea and the second is lacking from the Solomons. To be sure, future collections may modify this picture, and no conclusions should be drawn from our present incomplete knowledge of this distribution.

In proposing the genus (6: 278), van Tieghem states that it is typified by two species of Baillon, *Drimys crassifolia* and *D. Pancheri*, but in a subsequent footnote (6: 331) he states that, of the four species he refers to *Belliolium*, the flowers of only *B. Pancheri* are known. It is evident, therefore, that van Tieghem's concept of *Belliolium* is based primarily upon *B. Pancheri* and that this may be designated as the type species.

The first description of a plant belonging to this group is Baillon's description of *Drimys crassifolia*, which is proposed as the type of *Drimys* Sect. *Sarcodrimys*. This fact has no bearing upon the designation of a lectotype for *Belliolium* v. Tiegh. Van Tieghem's two sections are based upon the degree of branching of the inflorescence, but this is surely merely a detail of specific value and demonstrates no basic cleavage in the genus.

Burt (1) has discussed in some detail the reasons for his reduction of *Belliolium* to *Bubbia*, and I have elsewhere (3: 437-438) expressed the tentative opinion that the two genera are maintainable. The latter arrangement is continued in the present treatment, but the question can be finally settled only by the examination of more abundant material than is now available.

NEW CALEDONIAN SPECIES

To the four species, all from New Caledonia, upon which *Belliolium* was originally based, no more from that region have been added up to the present. As I have seen type material of only one of these species, a final evaluation of them is impossible, and it is even uncertain whether all of them belong in the genus, since *Bubbia* and *Belliolium* are not positively to be distinguished in the absence of stamens. The New Caledonian species are listed in the order suggested for them by van Tieghem.

1. **Belliolium Pancheri** (Baill.) v. Tiegh. in Jour. de Bot. **14**: 330. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Drimys Pancheri Baill. in *Adansonia* **10**: 336. 1873; Guillaumin in *Ann. Mus. Col. Marseille* **II**. **9**: 95. 1911; Bak. f. in *Jour. Linn. Soc. Bot.* **45**: 267. 1921.

Bubbia Pancheri Burt. in *Hook. Ic. Pl.* **34**: sub *pl.* 3315. 1936.

DISTRIBUTION: New Caledonia; in the original publication Baillon cites 6 specimens (of *Pancher*, *Viellard*, and *Balansa*) without indicating a type, but perhaps, because of the specific epithet, one should designate the *Pancher* collection ("inter sylvas, ad 300 metr. alt.") as the actual type. Guillaumin and Baker have added other specimens in their citations, but van Tieghem has definitely removed two of Baillon's original specimens from this concept and referred them to *Belliolum rivulare* and *Bubbia isoneura* respectively.

Belliolum Pancheri is the single species referred by van Tieghem to his Section *Monocladiscum*, characterized by having each ray of the inflorescence simply umbellate. Baillon's description of the stamens demonstrates beyond doubt that the species falls into *Belliolum* rather than *Bubbia*.

2. *Belliolum crassifolium* (Baill.) v. Tiegh. in *Jour. de Bot.* **14**: 330. 1900; Pilger in *E. & P. Nat. Pfl. Nachtr.* **2**: 109. 1906.

Drimys crassifolia Baill. in *Adansonia* **8**: 199. 1867, *Hist. Pl.* **1**: 159. 1867-69; Guillaumin in *Ann. Mus. Col. Marseille* **II**. **9**: 95. 1911.

Bubbia crassifolia Burt. in *Hook. Ic. Pl.* **34**: sub *pl.* 3315. 1936.

DISTRIBUTION: New Caledonia; the type and only specimen originally cited by Baillon is an unnumbered collection of *Viellard* from Balade. Guillaumin cites nine specimens as representing this species, in complete disregard of the fact that van Tieghem, some years earlier, had cited several of them as representing three other species of *Belliolum* and *Bubbia*.

I have seen no material which I can refer with certainty to *Belliolum crassifolium*. *Schlechter 15348* (A, GH), which has been referred to this species by Guillaumin, Burt., and the present writer (3: 437), does not agree in all respects with Baillon's description, but on the other hand it almost certainly represents none of the other three New Caledonian species referred to *Belliolum* in the present treatment.

3. *Belliolum Vieillardii* v. Tiegh. in *Jour. de Bot.* **14**: 331. 1900; Pilger in *E. & P. Nat. Pfl. Nachtr.* **2**: 109, as *B. Vieillardii*. 1906.

Drimys Vieillardii Baill. ex v. Tiegh. in *Jour. de Bot.* **14**: 331, as synonym. 1900.

DISTRIBUTION: New Caledonia; van Tieghem cites *Vieillard 16* and *47*, from Balade.

The species is said to be characterized by its stout branches and large leaves, but a comparison of van Tieghem's brief description with Baillon's description of *Drimys crassifolia* is not too convincing; a comparison of type material is obviously desirable.

4. *Belliolum rivulare* v. Tiegh. in *Jour. de Bot.* **14**: 331. 1900; Pilger in *E. & P. Nat. Pfl. Nachtr.* **2**: 109. 1906.

Drimys rivularis Vieill. ex Parment. in *Bull. Sci. Fr. & Belg.* **27**: 229, 306. *pl.* 10, f. 33, *nomen subnudum*. 1896; Vieill. ex v. Tiegh. in *Jour. de Bot.* **14**: 331, as synonym. 1900.

Bubbia rivularis Burt. in *Hook. Ic. Pl.* **34**: sub *pl.* 3315. 1936.

DISTRIBUTION: New Caledonia; known with certainty only from the type collection, *Vieillard 2278* (F, GH), from Wagape. Parmentier has based his concept in part on a collection by *Pancher* (l. c. 230), which may not be conspecific with the *Vieillard* specimen.

The type collection bears young fruiting carpels, which are fairly numer-

ous (5-8 per flower) and have a short subapical stigmatic ridge and ventral placentas. On the basis of the latter character, the species may fall into either *Belliolum* or *Bubbia*, and final determination must await the collection of flowering specimens. The small leaves, ascending secondaries, and large freely branching inflorescences characterize the species, which is quite distinct.

This species and the two preceding were placed by van Tieghem in his Section *Di cladiscum*, with the primary rays of the inflorescence branched twice. Actually, the inflorescence-rays of *B. rivulare* are 2, 3, or 4 times branched.

SOLOMON ISLANDS SPECIES

The four species of *Belliolum* from the Solomon Islands have all been recently described. As two of them are known in fruiting condition only, a dependable key cannot at present be proposed. However, characters of foliage and fruit amply differentiate the species, and the flowers of the first two species listed below indicate that good floral characters may also be expected in the others. For discussions of specific characters, the reader is referred to my earlier treatment (3). The species of this region are all characterized by having carpels with a short apical stigmatic ridge and horizontal placentas situated near the middle; that is, the placentas do not correspond in position to the external stigmatic surface. On the basis of present evidence, I judge that the New Caledonian species have a more primitive type of carpel, with the stigmatic ridge obliquely apical and the placentas more nearly corresponding to this position. Future study may indicate these characters to be a basis for sectional differentiation.

5. *Belliolum haplopus* (Burt) A. C. Sm. in Jour. Arnold Arb. **23**: 438. 1942.

Bubbia haplopus Burt in Hook. Ic. Pl. **34**: pl. 3315. 1936.

DISTRIBUTION: Solomon Islands; the type collection is *Waterhouse 90* (F, NY), from Bougainville, while other collections are *Kajewski 1658, 1994, and 2007* (all A), from Bougainville, and *Brass 2959* (A), from Ulawa. The species occurs in rain-forest at altitudes up to 850 m.

6. *Belliolum Burtianum* A. C. Sm. in Jour. Arnold Arb. **23**: 439. 1942. FIG. 5, a-c.

DISTRIBUTION: Solomon Islands, known only from the type, *Kajewski 1680* (A), from Bougainville, alt. 950 m.

7. *Belliolum gracile* A. C. Sm. in Jour. Arnold Arb. **23**: 439. 1942.

DISTRIBUTION: Solomon Islands; the type is *Brass 2898* (A), from San Cristoval; other collections are *Brass 3063 and 3063A* (both A), from San Cristoval, and *Kajewski 2630* (A), from Guadalcanal. The species grows in forest at 900-1700 m.

8. *Belliolum Kajewskii* A. C. Sm. in Jour. Arnold Arb. **23**: 440. 1942.

DISTRIBUTION: Solomon Islands, known only from *Kajewski 2099* (A, TYPE), from Bougainville, and *Kajewski 2574* (A), from Guadalcanal, at altitudes of 1200-1500 m.

4. PSEUDOWINTERA

Pseudowintera Dandy in Jour. Bot. **71**: 121. 1933.

Drimys J. R. & G. Forst. Char. Gen. 83, pro parte, excl. *D. Winteri*. 1776; sensu Cheesem. Man. N. Zeal. Fl. 29. 1906, ed. 2. 455. 1925.

Wintera sensu Forst. f. Fl. Ins. Austr. Prodr. 42. 1786; v. Tiegh. in Jour. de Bot. **14**: 277, 290. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Hutchinson in Kew Bull. **1921**: 190. 1921; non Murray (1784).

Drimys Sect. *Drimys* DC. Reg. Veg. Syst. Nat. **1**: 442. 1817.

Drimys Sect. *Eudrimys* DC. Prodr. **1**: 78. 1824; Baill. Hist. Pl. **1**: 158, 160. 1867-69.

Wintera Sect. *Euwintera* v. Tiegh. in Jour. de Bot. **14**: 291. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906.

Wintera Sect. *Pleurowintera* v. Tiegh. in Jour. de Bot. **14**: 291. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906.

The generic status of the New Zealand species of the Winteraceae has been subject to confusing vicissitudes. *Drimys* J. R. & G. Forst. was based



FIG. 5. *a-e*. *Belliolum Burtianum*, drawn from the type: *a*. flowering branchlet, $\times \frac{1}{2}$; *b*. flower, $\times \frac{3}{4}$; *c*. stamens, extrorse and introrse views, $\times 5$; *d*. carpel, $\times 3$; *e*. carpel, longitudinal section, $\times 3$. *f-j*. *Pseudowintera axillaris* var. *typica*, drawn from Cheeseman (Coromandel): *f*. flowering branchlet, $\times \frac{1}{2}$; *g*. flower, $\times 1\frac{1}{2}$; *h*. stamens, extrorse and introrse views, $\times 5$; *i*. carpel, $\times 5$; *j*. carpel, longitudinal section, $\times 5$. *k*, *l*. *Pseudowintera axillaris* var. *colorata*, drawn from Cockayne 183: *k*. fruit, with two mature carpels, $\times 1\frac{1}{2}$; *l*. seed, $\times 3$.

in part upon the New Zealand *D. axillaris*, but van Tieghem, who first definitely broke up the inclusive generic concept, took the Magellanic *D. Winteri* as the genotype, leaving the New Zealand *D. axillaris* without a generic name. The fact that De Candolle had earlier selected *D. axillaris* as representing *Drimys* Sect. *Drimys* (or Sect. *Eudrimys*) does not affect the typification of the genus. In 1786, the younger Forster, following Murray, apparently abandoned the generic name *Drimys* and took up the later *Wintera* Murr., applying it to the New Zealand species. In so doing, Forster did not propose *Wintera* as a new genus. However, van Tieghem

applied to the generic concept based on *Drimys axillaris* the name "*Wintera* Forster, non Murray," remarking (6: 277) that: "Le nom de *Wintera* Murray n'existe pas." This curious conclusion does not alter the fact that *Wintera* is a direct synonym of *Drimys* and is applicable only to the concept based on *D. Winteri*. Dandy (2) has discussed the problem and has quite properly proposed the new generic name *Pseudowintera* for the New Zealand species, selecting *Drimys axillaris* as the type species.

Pseudowintera is not closely related to *Drimys*, having a type of calyx, stamen, and carpel much more suggestive of the genus *Bubbia*, which is certainly its closest ally. On floral characters it is difficult satisfactorily to separate these two genera, but the inflorescence of *Bubbia* is always terminal or pseudoterminal, the primary rays of the inflorescence (or the flowers, when these are single) being arranged around the growing point of the branchlets. When the growing point protrudes through the inflorescence, this may persist for a short while in a pseudolateral position, as in *Drimys*, but at its inception the inflorescence is essentially terminal. In *Pseudowintera*, on the other hand, the inflorescence is axillary at its inception, and flowers arise from a lateral position often on branchlets of several years' growth. Furthermore, the flowers are comparatively reduced in size and the inflorescence is greatly compacted, while the small leaves give a distinct facies to the New Zealand species. The wood-ray is of a different aspect, as will be discussed in a future consideration of intergeneric relationships.

Van Tieghem's two sections are based upon the supposed position of the inflorescence, which he states to be both axillary and terminal in Sect. *Euwintera* (as represented by *Wintera terminalis* v. Tiegh.) and only axillary in Sect. *Pleuowintera* (as represented by three other species). Dandy points out that *W. terminalis* is merely an inconsequential form of *Pseudowintera axillaris*; van Tieghem's sections have no real foundation.

Current opinion among students of this group recognizes three species, but I am unable to distinguish *Pseudowintera colorata* from *P. axillaris* as a species, and therefore I find the genus to consist of only two species, one of which has two varieties.

KEY TO THE SPECIES

- Erect bushy shrub or small tree 2-10 m. high, the branchlets cinereous or purplish or brownish; leaf-blades usually 3-11 cm. long; flowers in fascicles of 2-10, rarely solitary; petals 4-6.5 mm. long; stamens 10-18, rarely as few as 6; carpels usually 2 or 3 (rarely 1, 4, or 5) 1. *P. axillaris*.
 Compact shrub to 2 m. high, the branchlets reddish; leaves crowded, the petioles closely appressed to branchlets, the blades 2-3 cm. long; flowers often solitary, sometimes paired; petals about 3 mm. long; stamens 5 or 6; carpel solitary .. 2. *P. Traversii*.

1. *Pseudowintera axillaris* (J. R. & G. Forst.) Dandy in Jour. Bot. 71: 121. 1933.

Glabrous shrub or tree, up to 10 m. high, the branchlets subterete, rugulose, cinereous or purplish or brownish, slender, 1-3 mm. in diameter toward apices; petioles rugulose, shallowly canaliculate, 5-10 mm. long, 0.8-1.5 mm. in diameter; leaf-blades subcoriaceous, rarely subpapyraceous, olivaceous or dark brown above when dried, usually paler beneath and copiously white- or brownish-punctate, usually glaucous beneath in var. *colorata* and

often coated with a smooth thin layer of wax, obovoid-elliptic or elliptic, (1.5-)3-11(-12.5) cm. long, (1-)1.5-5 cm. broad, acute at base and decurrent on the petiole, obtuse at apex, essentially plane or narrowly recurved at margin, the costa plane or slightly grooved above, prominent beneath, the secondary nerves 4-12 per side, erecto-patent, copiously anastomosing, prominulous or nearly plane above, prominulous beneath, the veinlets forming a fine reticulum, prominulous or obscure on both surfaces; inflorescences axillary or arising from defoliate branchlets, the flowers fasciculate in clusters of 2-10, rarely solitary, usually borne on pulvinate glomerules, subtended by minute deltoid subcoriaceous bracts; pedicels slender, 5-15(-21) mm. long; calyx papyraceous, essentially eglandular, rotate, 2.5-3.5 mm. in diameter, entire or irregularly crenate or shallowly 2-lobed, the lobes broadly ovate, up to 1.5 mm. long and 2.5 mm. broad, rounded or obtuse at apex, entire or slightly crenulate or shallowly 3-dentate; petals 5 or 6, submembranaceous or thin-carnose, copiously opaque-glandular, oblong or obovate-oblong, 4-6.5 mm. long, 2-3.5 mm. broad (inner ones sometimes reduced to 1-2 mm. in width), obtuse or rounded at apex; stamens (6-)10-18, often 2-seriate, oblong-obovate, flattened, carnose, 1.2-2 mm. long, the filaments narrowed at base, broadened to 0.5-1 mm. distally, yellow-glandular distally, the pollen-sacs oblique on the distal margin, ellipsoid, 0.3-0.5 mm. long, dehiscing by lateral-apical clefts, contiguous or slightly separated but not exceeded by the truncate apex of filament; carpels usually 2 or 3 (rarely 1, 4, or 5), obovoid, 1.3-2 mm. long at anthesis, rounded at apex, the stigmatic ridge short, linear-oblong, 0.2-0.5 mm. long, strictly apical or obliquely subapical, the ovary-wall densely glandular, the ovules 8-10, pendulous from short subapical or obliquely apical placentas; carpels in fruit usually reduced to 1, sometimes 2 or 3, subglobose, 5-6 mm. in diameter at maturity, rounded at base and apex, the stigmatic ridge essentially apical, inconspicuous, the pericarp subcarnose, densely glandular, rugulose without, the seeds (2-)3-6 at maturity, obovoid, 3-4 mm. long, 1.5-2.5 mm. broad, obtuse at base, rounded at apex.

In view of the difficulty one has in separating herbarium specimens of *Pseudowintera axillaris* and *P. colorata*, an examination of works on the New Zealand flora in which this problem is considered is of interest. Raoul, in 1846, described the new species *Drimys colorata* without comparing it with *D. axillaris*. Hooker, in 1852, merely remarks: "I cannot distinguish the *D. colorata* of Raoul from Forster's plant." Kirk, in 1889, reduced *Drimys colorata* to a variety of *D. axillaris*, pointing out that the former is essentially a southern plant in New Zealand and the latter essentially northern, although the two overlap in the Wellington region; he further remarks that "the characters stated above [var. *colorata*] pass into those of the typical form by almost imperceptible gradations." Cheeseman, in 1906, retains both species but remarks: "I have considerable hesitation in re-establishing this [*Drimys colorata*] as a species. It is certainly very close to the preceding [*D. axillaris*], and in the dried state it is often difficult to separate the two. But in the field it can always be readily distinguished, and all my correspondents regard it as distinct. The two species grow intermixed in many localities in the Wellington and Nelson Districts." Cockayne, in 1928, retains both species, pointing out the distributional differences and stating that *Drimys axillaris* is much taller than

D. colorata and has larger, glossy, dark green leaves, rather than yellowish green leaves, which are blotched red or purple and are glaucous beneath.

The prevalent modern opinion seems to be that the two species are distinguishable and are good entities, although it is admitted that hybridization occurs in the region where the two ranges overlap. Naturally, New Zealand botanists who have observed the genus in nature are best qualified to judge how distinct the two plants actually are, and for that reason I hesitate to go back to the earlier opinions and combine them. However, a careful examination of the cited specimens shows that there are absolutely no floral distinctions, with the possible exception of a slight and undependable tendency toward more entire calyces in *Pseudowintera colorata*. As to the differences in habit and foliage pointed out by various students, these are scarcely noticeable in herbarium material, although the extreme forms are of course easily distinguished. For instance, the leaf-blades of such specimens as *Colenso* and *Cockayne 183* are grayish white beneath, and one would have no hesitation in referring them to Raoul's species. But the leaf-blades of *Cockayne 3470* and the *Setchell* collection are only slightly paler beneath and sometimes nearly concolorous; yet these also doubtless represent Raoul's species. The best distinction one can make between the two groups, I believe, is based on tendencies toward a smaller habit, smaller leaves, and paler lower leaf-surfaces in *Pseudowintera colorata*. If these characters could be linked with any pertaining to the inflorescence, however inconspicuous, one would feel justified in retaining both species, but my present opinion is that only one specific entity can be admitted.

In view of the differences pertaining to habit and leaf color, however, I cannot altogether ignore the entity based on *Drimys colorata*, especially as this has a more or less distinct geographic range and is apparently readily recognized in a living condition. Therefore I propose varietal combinations for the two entities, one based on the Forsters' type and the other on Raoul's species. The description which I have given above is comprehensive, while the few points which differentiate the varieties are pointed out below.

1a. ***Pseudowintera axillaris* var. *typica* nom. nov.** FIG. 5, f-j.

Drimys axillaris J. R. & G. Forst. Char. Gen. 84. f. 42, a-l. 1776; Forst. f. in Nova Acta Reg. Soc. Sci. Ups. 3: 182. 1780; L. f. Suppl. 270. 1781; Lam. Encycl. 2: 331. 1786; DC. Reg. Veg. Syst. Nat. 1: 443. 1817, Prodr. 1: 78. 1824; A. Rich. Bot. Voy. Astrolabe 290. 1832; Endl. Enchir. Bot. 430. 1841; Hook. f. in Hook. Ic. Pl. 6: pl. 576. 1843; Raoul, Choix de Pl. Nouv.-Zél. 47. 1846; Hook. f. Fl. Nov. Zél. 1: 12. 1852; Miers in Ann. Mag. Nat. Hist. III. 2: 43. 1858, Contrib. Bot. 1: 132. 1861; Hook. f. Handb. N. Zeal. Fl. 10. 1864; Baill. Hist. Pl. 1: 158. f. 203, 204. 1867-69; Kirk, Forest Fl. N. Zeal. pl. 1. 1889; Featon, Art Alb. N. Zeal. Fl. 12. pl. 5, f. 3. 1889; Kirk, Students' Fl. N. Zeal. 22. 1899; Cheesem. Man. N. Zeal. Fl. 29. 1906, ed. 2. 456. 1925.

Wintera axillaris Forst. f. Fl. Ins. Austr. Prodr. 42. 1786; Willd. Sp. Pl. 2: 1240. 1800; Pers. Syn. Pl. 2: 84. 1806; v. Tiegh. in Jour. de Bot. 14: 290. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. 2: 108. 1906; Cockayne in Bull. N. Zeal. State For. Serv. 4(2): 43. 1928, in Engl. & Drude, Veg. der Erde ed. 2. 14: 125. 1928.

Wintera terminalis v. Tiegh. in Jour. de Bot. 14: 291. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. 2: 108. 1906.

Pseudowintera axillaris Dandy in Jour. Bot. 71: 121. 1933.

Tree 4–10 m. high; leaf-blades (3–)4–11(–12.5) cm. long, often paler beneath but scarcely glaucous, the waxy layer inconspicuous, the secondary nerves usually 6–12, the veinlets usually prominulous but often obscure on both surfaces; calyx crenulate or bilobed, rarely entire.

DISTRIBUTION: North Island (from Ahipara and Bay of Islands [lat. about 35°] southward) and northern part of South Island, not occurring south of the Banks Peninsula (lat. about 43° 45'), at altitudes from sea-level to about 850 m.; apparently often occurring in mixed beech forest, or occasionally in pure beech forest (ex Cockayne). The type was collected by the Forsters, but no definite locality was noted.

NEW ZEALAND: North Island: Coromandel, *Cheeseman* (US); Mt. Egmont Ranges, *Tryon* (A); Ohakune, *Oliver* (UC); Wellington, *Travers* (GH); Hunua, *Kirk* (A, F, GH, M), 347 (GH, US); without definite locality: *Cheeseman* (F).

NATIVE NAME: *Horopito*.

Wintera terminalis v. Tiegh. is based on a specimen collected by Sinclair, without definite locality, which is said to differ from the other New Zealand species in having its inflorescences both axillary and terminal; upon this species van Tieghem based his Section *Euwintera*. Although the original description is quite inadequate, I cite this as a synonym of the Forsters' concept on the authority of Dandy.

1b. *Pseudowintera axillaris* var. *colorata* (Raoul) comb. nov. FIG. 5, k, l.

Drimys colorata Raoul in Ann. Sci. Nat. III. 2: 121. 1844, *Choix de Pl. Nouv.-Zél.* 24. pl. 23. 1846; Parment. in Bull. Sci. Fr. & Belg. 27: 227, 303. 1896; *Cheesem. Man. N. Zeal. Fl.* 30. 1906, ed. 2. 456. 1925.

Drimys axillaris var. *colorata* Kirk, *Forest Fl. N. Zeal. pl.* 2. 1889, *Students' Fl. N. Zeal.* 22. 1899.

Wintera colorata Raoul ex v. Tiegh. in Jour. de Bot. 14: 290. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. 2: 108. 1906; Cockayne in Bull. N. Zeal. State For. Serv. 4(2): 43. 1928, in Engl. & Drude, *Veg. der Erde* ed. 2. 14: 125. 1928.

Wintera monogyna v. Tiegh. in Jour. de Bot. 14: 291. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. 2: 108. 1906.

Pseudowintera colorata Dandy in Jour. Bot. 71: 121. 1933.

Erect bushy shrub or small tree, usually not exceeding 4 m. in height; leaf-blades (1.5–)3–9 cm. long, sometimes blotched with red or purple, usually glaucous beneath, often conspicuously so, the waxy layer often conspicuous, the secondary nerves usually 4–6, the veinlets usually obscure on both surfaces; calyx often entire, rarely crenulate or bilobed.

DISTRIBUTION: North, South, and Stewart Islands, said to occur from Patetere Plateau and Rotorua (lat. about 38°) southward, at altitudes of sea-level (toward the south and in Stewart Island, where it is reported as common) to about 1000 m.; usually subalpine or montane in North Island. The type is the Raoul collection cited below.

NEW ZEALAND: Poketitiri, *Meebold* 5548 (NY); North Island: Kirk (GH); Wellington, *Travers* (GH); South Island: Otira Valley, *Cockayne* 183 (GH), 3470 (NY); Akaroa, Banks Peninsula, *Raoul* (TYPE COLL., GH, US), *Kirk* (A, F, M); Mt. Sinclair, Banks Peninsula, *Meebold* 4710 (NY); Hunter Hills, South Canterbury, *Anderson* 213 (A, M, NY, UC, US); Lake Manipouri, *Setchell* (UC); without definite locality: *Colenso* (GH), *Védel* (US), *Oliver* (UC).

NATIVE NAMES: *Pepper-tree*, *craoutink* (ex Raoul). In discussing *Drimys axillaris*, Featon uses the names *pepper-tree* and *Maori painkiller*, which are more likely to refer to var. *colorata*.

Dandy has referred *Wintera monogyna* v. Tiegh. to the synonymy of *Pseudowintera Traversii*, but I am more inclined to believe that it represents the present variety. It is said to differ from Raoul's species in its smaller and more rounded leaves and especially in its single carpel. The latter character has been noted in some specimens of var. *colorata*, and the leaf-shape is too variable to be of much consequence. Van Tieghem does not mention the stamens as being exceptionally few in number, a point which he probably would have emphasized if his plant represented *P. Traversii*. Furthermore the type of *Wintera monogyna* was collected by Hombron at Akaroa (the type locality of Raoul's species), whereas *P. Traversii* has not been authentically reported from that part of the South Island.

2. ***Pseudowintera Traversii*** (Buchanan) Dandy in Jour. Bot. **71**: 122. 1933.

Hymenanthera Traversii Buchanan in Trans. New Zeal. Inst. **15**: 339. *pl.* 28, *f.* 1-1b. 1883.

Drimys Traversii Kirk in Trans. New Zeal. Inst. **30**: 379. 1898; Cheesem. Man. N. Zeal. Fl. **30**. 1906, ed. 2. 456. 1925, Ill. N. Zeal. Fl. **1**: *pl.* 8. 1914.

Wintera Traversii Cockayne in Bull. N. Zeal. State For. Serv. **4**(2): 43. 1928, in Engl. & Drude, Veg. der Erde ed. 2. **14**: 262. 1928.

DISTRIBUTION: South Island, apparently limited to the northwestern portion, from near the northern tip of the island southward to the Buller River region, probably not occurring much farther south than latitude 42°; altitude up to about 900 m. The type was collected by Travers in the Collingwood district.

Having seen no specimens referable to this species, I am acquainted with it only through the above references. The descriptions of Kirk and Cheeseman (in 1906) are quite adequate, and an excellent plate was published by Cheeseman in 1914. The species is characterized by its compact habit, being a shrub from 0.7 to 2 m. high, often straggling or semi-prostrate, with reddish branches and branchlets. The leaves are crowded and more or less imbricate, with petioles closely appressed to the branchlets and with coriaceous blades which are 2-3 cm. long, 0.8-1.3 cm. broad, and glaucous beneath. The pedicels are often solitary, sometimes paired; the calyx is entire, the petals 5 or 6 and about 3 mm. long, the stamens 5 or 6 and uniseriate, and the carpel solitary.

5. EXOSPERMUM

Exospermum v. Tiegh. in Jour. de Bot. **14**: 279, 333. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Hutchinson in Kew Bull. **1921**: 190. 1921.

Exospermum is known only from the two New Caledonian species upon which it was originally founded; the type is *E. stipitatum*. Van Tieghem's classification (6: 354) has the genus most closely related to *Zygogynum*, with which it has in common "carpelles unis, à placentation médiane." In his discussion, however, van Tieghem points out that the carpels of *Exospermum* are only superficially united and not firmly conrescent as in *Zygogynum*, while the placentation of *E. Lecarti* (6: 339) is "en même temps marginale, latérale et médiane pour chaque carpelle . . ." In effect, the genus is more suggestive of *Bubbia* than of *Zygogynum* and might conceivably be combined with the former, although for the present I feel justified in retaining it as outlined by van Tieghem.

1. *Exospermum stipitatum* (Baill.) v. Tiegh. ex Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Hutchinson in Kew Bull. **1921**: 190. fig. 1921. FIG. 6, a-e.
Zygogynum stipitatum Baill. in Adansonia **10**: 334. 1873; Guillaumin in Ann. Mus. Col. Marseille II. **9**: 95. 1911.
Drimys neo-caledonicus Vieill. ex Baill. in Adansonia **10**: 335, as synonym. 1873.
Drimys Lenormandii Vieill. ex Parment. in Bull. Sci. Fr. & Belg. **27**: 231, 308. pl. 10, f. 35, pl. 11, f. 42, 43, *nomen subnudum*. 1896; Vieill. ex v. Tiegh. in Jour. de Bot. **14**: 333, as synonym. 1900; Vieill. ex Guillaumin in Ann. Mus. Col. Marseille II. **9**: 95, *nomen*. 1911.
Drimys austro-caledonicus Vieill. (pro parte) ex v. Tiegh. in Jour. de Bot. **14**: 333, as synonym. 1900.

DISTRIBUTION: New Caledonia; the type was collected by Vieillard at Wagap (ex Baillon), or "dans les montagnes de Ti-Ouaka près de Wagape" (ex van Tieghem); a single leaf of this is available (A). Van Tieghem also cites *Vieillard 2281* (GH), the source of the name *Drimys Lenormandii*; from a comparison of the foliage, one may suspect that this is the same collection as the type, which was unnumbered.

Van Tieghem's description of this species is very detailed and accurate, although my observations of the gynaeceum lead me to believe that he attaches too much importance to the regularity of the carpel-arrangement. In one flower available to me there are 6 carpels in a single whorl, in a second flower there are 7 carpels, of which one has apparently been pushed into the center by pressure. Van Tieghem reports the carpels as occurring in two whorls of 3-5 carpels each. No petals are available on our material, but van Tieghem describes these as occurring in three tetramerous whorls, implying a degree of regularity which is not found in the related genera. In this species the placentation is said to be limited to the external face of the carpels, but actually the ovules also occupy a portion of the distal lateral faces and the apical-ventral angle.

In his treatment of the plant, van Tieghem neglected to make the actual combination *Exospermum stipitatum*, apparently through an oversight, for he repeatedly mentions "Exosperme stipité" and gives *Zygogynum stipitatum* as a synonym. It appears that Pilger was the first to use the correct Latin binomial.

2. *Exospermum Lecarti* v. Tiegh. in Jour. de Bot. **14**: 334. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

DISTRIBUTION: New Caledonia, reported only from the type collection, *Lécart 141*, without definite locality; probably a detached leaf (A) under this name, but labelled *Lécart 144*, is actually from the same collection.

Van Tieghem mentions that this is similar in foliage to the preceding, but differs from it by its usually solitary and short-pedicellate flowers, fewer carpels, and more extensive placental surface. The ovules are said to be situated at the internal angle of the carpel, on the lateral faces, and also on the external face. This is interpreted, by van Tieghem, as a transitional stage between the carpel of *Bubbia* and *Belliolum* (which he supposes always to have the ovulation along the ventral angle) and that of *Exospermum stipitatum*, in which the ovules are supposedly situated only on the external face of the carpel. The carpels of *E. Lecarti* are only weakly united, and in this respect the species is similar to some species of *Bubbia*, i.e. *B. montana* (Lauterb.) A. C. Sm. and *B. pachyantha* A. C. Sm. It

appears that the ovulation in *Bubbia* and *Belliolum* is more diverse than supposed by van Tieghem, and the placental surface is not always restricted to the ventral angle of the carpel in those genera. Consequently, the primary characters upon which *Exospermum* is founded do not sharply distinguish the genus from *Bubbia* and *Belliolum*, although the stamens amply separate it from the latter. However, I do not propose to unite *Exospermum* with *Bubbia*; although it doubtless represents an extreme trend from a *Bubbia*-like ancestor, it seems to be sufficiently characterized by its ovulation to merit generic status. However, I believe that its closest alliance is with *Bubbia* rather than with *Zygogynum*.



FIG. 6. a-e. *Exospermum stipitatum*, drawn from Vieillard 2281: a. branchlet with two flowers past anthesis, $\times \frac{1}{2}$; b. flower, past anthesis, the petals and stamens having fallen, $\times 2$; c. stamens, extrorse and introrse views, $\times 5$; d. carpel, $\times 2$; e. carpel, longitudinal section, showing the glandular wall and the scattered ovules, $\times 2$. f-j. *Zygogynum Vieillardii*, drawn from Franc 1740: f. branchlet with solitary terminal young flower, $\times \frac{1}{2}$; g. flower with calyx and petals removed, $\times 1\frac{1}{2}$; h. stamens, extrorse and introrse views, $\times 5$; i. longitudinal section of young flower, showing torus with stamens and fused carpels, $\times 2$; j. enlarged section of i, showing two stigmas, one locule (with one row of ovules removed), and the connecting canal, $\times 4$.

6. ZYGOGYNUM

Zygogynum Baill. in Adansonian 7: 298. 1867, Hist. Pl. 1: 160, 190. 1867-69; Prantl in E. & P. Nat. Pfl. III. 2: 19. 1891; v. Tiegh. in Jour. de Bot. 14: 279, 340. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. 2: 109. 1906; Hutchinson in Kew Bull. 1921: 191. 1921.

Zygogynum Sect. *Monanthum* v. Tiegh. in Jour. de Bot. **14**: 341. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Zygogynum Sect. *Pleianthum* v. Tiegh. in Jour. de Bot. **14**: 341. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Zygogynum has been generally accepted by workers on the New Caledonian flora as a good genus. It is indeed the most distinct genus of the family in many respects, with a unique type of carpellary specialization. No species have been added to *Zygogynum* since it was amplified by van Tieghem to include six species. In *Zygogynum* the carpels are firmly concrescent and the ovules are limited to the external face of the locule; van Tieghem interprets these facts as a continuation of the trend begun in *Exospermum*, which may indeed be true, although the remarkable syncarpy of *Zygogynum* is only faintly suggested by the loosely coherent carpels of *Exospermum*. The two genera have a common aspect in their reduced inflorescences, the flowers being either solitary and terminal or few in a terminal umbel (perhaps more properly described as single and clustered around the growing point).

The two sections proposed by van Tieghem are based on solitary versus aggregated flowers, a division which seems arbitrary and not very useful, since the flowers in the second group are often reduced to one soon after anthesis. The principal basis of speciation may eventually be found to occur in the gynaecium, as suggested by van Tieghem (6: 347-348), the number and disposition of the carpels varying from species to species.

Baillon's paper discussing his new species does not include a formal generic description, nor does the generic name appear as an independent entity in the text, being first mentioned as such in a brief summary (op. cit. 372). However, the description of *Zygogynum Vieillardii* may be taken as a *descriptio generico-specifica*.

The species are here briefly discussed in the order proposed by van Tieghem.

1. ***Zygogynum Vieillardii*** Baill. in *Adansonia* **7**: 298. pl. 4. 1867, Hist. Pl. **1**: 161. f. 208-210. 1867-69; Parment. in Bull. Sci. Fr. & Belg. **27**: 232. 1896; v. Tiegh. in Jour. de Bot. **14**: 340. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109, as *Z. Vieillardii*. 1906; Guillaumin in Ann. Mus. Col. Marseille II. **9**: 95. 1911. FIG. 6, i-j.

DISTRIBUTION: New Caledonia; the type collection is *Vieillard 187*, from mountains near Balade. Guillaumin adds citations of *Pancher 17* and *283* from Mt. Koghi, neither of which I have seen, and *Balansa 2763* from Mt. Mou, of which a fragment (A) seems very possibly to represent this species, although it is also suggestive of *Z. Bailloni*. The only specimen in American herbaria which I can positively refer to *Z. Vieillardii* is *Franc 1740* (A, UC), from Prony.

The species is well described and figured by Baillon; it is characterized by its 10-12 concrescent carpels with elliptic or subcapitate stigmas.

2. ***Zygogynum Bailloni*** v. Tiegh. in Jour. de Bot. **14**: 340. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109, as *Z. Baillonii*. 1906.

DISTRIBUTION: New Caledonia; the type was collected by Pancher in 1870, apparently without number or definite locality, and is represented by a leaf (A) which is essentially identical to those of *Franc* (A), from Mt. Mou, a sterile specimen which may be referred to *Z. Bailloni* with reasonable certainty.

Zygogynum Bailloni is compared by van Tieghem to *Z. Viellardi*, from which it differs in having its leaf-blades more coriaceous and glossy, and in having 4 carpels with sessile linear stigmas rather than 10–12 carpels with elliptic stigmas. This is the only species of the genus elaborated in detail by van Tieghem (6: 341–345); it is said to have a very short and stout pedicel, 8 petals in two whorls, and carpels concrescent except at the apices. The difference in stigmatic characters between this species and the remaining species of *Zygogynum* causes van Tieghem (6: 348) to speculate on its generic status. On the basis of his discussion, one might assume that *Z. Bailloni* is the most primitive species of the genus in its retention of a linear stigmatic ridge.

3. *Zygogynum bicolor* v. Tiegh. in Jour. de Bot. **14**: 341. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

DISTRIBUTION: New Caledonia; reported only from the type collection, *Lécart 41* (A, leaf), without definite locality.

Zygogynum bicolor is said by van Tieghem to resemble *Z. Vieillardii* in its solitary flower on a short stout pedicel, but it is distinguished by having its leaf-blades very pale beneath and is further characterized by its very numerous stamens, 147–168 in 7 or 8 whorls (6: 346).

4. *Zygogynum pomiferum* Baill. in Adansonia **10**: 334. 1873; v. Tiegh. in Jour. de Bot. **14**: 340. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Guillaumin in Ann. Mus. Col. Marseille II. **9**: 95. 1911.

DISTRIBUTION: New Caledonia; the species was originally based by Baillon on two collections, *Balansa 2328* (A, TYPE COLL.), from Kanala (alt. 800 m.), and *2804*, from Mt. Mou. Van Tieghem did not believe these to be conspecific and took the first as the type, referring the second to his *Z. Balansae*. Guillaumin cites a collection of Lecard from Bourail as representing *Z. pomiferum*.

The original description is ample, the species being distinguishable from all others except the following by its comparatively broad leaf-blades. The type collection is in fruit only.

5. *Zygogynum Balansae* v. Tiegh. in Jour. de Bot. **14**: 340. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Bak. f. in Jour. Linn. Soc. Bot. **45**: 268. 1921.

DISTRIBUTION: New Caledonia; the type collection is *Balansa 2804*, from Mt. Mou, alt. 700 m. Baker cites *Compton 1776*, from Mt. Panié, as representing the species.

Zygogynum Balansae is compared by van Tieghem with *Z. pomiferum*; it has similarly large leaves and flowers grouped in a simple sessile umbel, but it is said to differ in having the leaf-blades less coriaceous, longer, narrower, distally attenuate, and with the lateral nerves more distant and "plus reticulées." It is further characterized by its very numerous carpels and large fruits, these being up to 4 cm. in diameter, according to van Tieghem (6: 348).

6. *Zygogynum spatulatum* v. Tiegh. in Jour. de Bot. **14**: 341, as *Z. spatulatum*. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Drimys austro-caledonicus Vieill. (pro parte) ex v. Tiegh. in Jour. de Bot. **14**: 341, as synonym. 1900.

DISTRIBUTION: New Caledonia; reported only from the original collection, *Vieillard 2266* (GH, TYPE COLL.) from Wagape.

Zygogynum spathulatum resembles *Z. pomiferum* and *Z. Balansae* in having its flowers aggregated, but it is distinguished by its narrow spatulate leaf-blades, which are rounded at apex and attenuate at base. The carpels are about 20 in number.

PRINCIPAL LITERATURE CITED

1. BURTT, B. L. *Bubbia haplopus*. Hook. Ic. Pl. **34**: *pl.* 3315 (pp. 1-3). 1936.
2. DANDY, J. E. The Winteraceae of New Zealand. Jour. Bot. **71**: 119-122. 1933.
3. SMITH, A. C. Studies of Papuasian Plants, V. Jour. Arnold Arb. **23**: 417-443. 1942.
4. ———. The American species of *Drimys*. Jour. Arnold Arb. **24**: 1-33. *f.* 1-3. 1943.
5. ———. La Distribution géographique et l'Histoire des Winteraceae. Boissiera, 1943 (in press).
6. TIEGHEM, P. VAN. Sur les dicotylédones du groupe des Homoxylées. Jour. de Bot. **14**: 259-297, 330-361. 1900.
7. VICKERY, JOYCE W. Two new species and one new variety of *Drimys* Forst., with notes on the species of *Drimys* and *Bubbia* van Tiegh. of south-eastern Australia and Lord Howe Island. Proc. Linn. Soc. N. S. Wales **62**: 78-84. *f.* 1, 2; *pl.* 5. 1937.
8. WHITAKER, T. W. Chromosome number and relationship in the Magnoliales. Jour. Arnold Arb. **14**: 376-385. *f.* 1-4; *pl.* 80. 1933.

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NOVELTIES IN AMERICAN EUPHORBIACEAE

LEON CROIZAT

THE new species, trinomials, and records in this work have accumulated with few exceptions in the herbarium of the Arnold Arboretum of Harvard University in the course of routine determinations. They are published primarily to validate the manuscript names under which many of them have been cited in letters to various correspondents. Some of the entities dealt with here belong to critical groups which are worthy of more detailed consideration, or which should be critically revised. Unless otherwise stated, all the types are deposited in the herbarium of the Arnold Arboretum.

Ditaxis Vahl ex A. de Jussieu

Ditaxis breviramea (Muell.-Arg.) Pax & Hoffm. in Pflanzenr. 57 (IV. 147. vi): 65. 1912; O'Donnel & Lourt. in Lilloa 3: 67. 1942.

Argythamnia breviramea Muell.-Arg. in Linnaea 34: 146. 1865, in DC. Prodr. 15(2): 737. 1866.

PARAGUAY: Fortin Lopez de Filippis, *Rojas* 8438; Fortin Tte. Montania, *Rojas* 8479.

The record is apparently new for Paraguay. The material cited agrees with a photograph of the Herzog specimen from Bolivia identified as *Ditaxis breviramea* by Pax, in Med. Rijks. Herb. 40: 22. 1921, and reproduced as plate 1 in the excellent monograph by O'Donnel & Lourteig.

Bernardia Adanson**Bernardia Gentryana** sp. nov.

Arbuscula ad 5 m. alta, innovationibus strictis stellato- vel fasciculato-puberulis. Foliis tenuiter membranaceis ovatis vel ovato-lanceolatis parcius stellato-puberulis vel glabratis margine inaequaliter dentato-serratis, 3.5–5 cm. longis, 1.5–2.5 cm. latis, nervis adscendentibus ca. 7-jugis gracilibus, glandulis cicatricoso-crateriformibus in basi laminae 2, petiolo ca. 3–5 mm. longo. Floribus ♂ ignotis. Floribus ♀ subsolitariis brevissime pedicellatis, perianthii squamulis 8–10 in serie duplici, ovatis puberulis costulatis ad 1.5 mm. longis latisque, ovario globuloso depresso ad 2 mm. lato fere totidem longo pallide luteo-tomentello, stylis 3 quove lunulato apice in laciniis 3(–6) partito ad 1.5 mm. longo; capsula submatura ca. 5 mm. magna, semine cordiformi 5 mm. longo, 3.5–4 mm. lato, pallide brunneo-marmorato.

MEXICO: Sinaloa: Nuevo Mundo, *Gentry* 5372 (TYPE in Gray Herb.).

This cannot be *Bernardia aspera* Pax & Hoffm., *B. incana* Mort., *B. mexicana* Muell.-Arg. (at least as illustrated by *Pringle* 3700), *B. obovata* Johnst., or *B. viridis* Millsp., as it disagrees with each one of them in its thinly membranous, ovate to ovate-lanceolate leaves, which are ultimately larger in size. *Bernardia Brandegei* Millsp. ex Brandeg., in Proc. Cal. Acad. Sci. II. 3: 172. 1891, is a *nomen nudum* replaced by *B. viridis* at publication, as shown by the notes that appear on the photograph of the type of *B. viridis* Millsp. preserved in the Gray Herbarium.

***Bernardia amazonica* sp. nov.**

Fruticulus vel frutex ad 1 m. altus, ramulis strictis puberulis. Foliis lanceolatis vel obovato-lanceolatis firme chartaceis vel subcoriaceis 5–10 cm. longis 1.75–2.5 cm. latis, brunneis vel olivaceis subconcoloribus, supra subtusque fere glabratiss, margine saepius glanduloso-serratis, nervis ascendentibus 7–10-jugis, lamina subtus ad petioli radicem potius cicatricosa quam glandulosa, cicatricibus 2, petiolo hispidulo vix 0.5 cm. longo vel minore, stipulis setaceis vix 2 mm. longis. Floribus ♂ haud visis. Floribus ♀ in cymulis sessilibus axillaribus, perianthii squamulis in serie duplici 9 vel 10 ovatis margine integro hispidis, 2 mm. longis, 1–2 mm. latis, ovario vix 1 mm. longo latoque cum stylis confluyente, stylis 3 ad 1 mm. longis apice divaricato-partitis.

VENEZUELA: Amazonas: Puerto Ayacucho, *Williams* 13142.

This was distributed as representing *B. Jacquiniana* Muell.-Arg., which is a very different species. It suggests *B. axillaris* (Spreng.) Muell.-Arg. in habit and foliage, but manifestly differs from that species in the venation, the texture of the leaf, and in its indumentum. As shown by a Brazilian specimen collected by Riedel, in our herbarium, *B. axillaris* has glabrous leaves with an immersed venation and differently shaped marginal teeth.

Alchornea* Swartz**Alchornea cyclophylla* sp. nov.**

Arbor videtur glabra vel glabrescens. Foliis subcoriaceis brunneis utrinque glabratiss in axillis nervorum barbulatis late rotundato-ovatis, apice breviter apiculato-acuminatis, basi leviter cordatis, margine obscure crenato-serratis, ca. 15 cm. longis, 12–13 cm. latis, nervis ca. 4- vel 5-jugis adscendentibus, primo jugo laminae tertium superum attingente caeteris penninerviis, glandulis in lamina hic inde sparsis parvis, petiolo 5.5–8 cm. longo, stipulis subglandulosis minimis deciduis. Inflorescentiis ♂ ignotis. Inflorescentiis ♀ spicatis puberulis vel glabratiss, floribus solitariis vel binis subsessilibus bracteolatis, calycis lobis triangulari-acuminatis 4(–5), vix 1 mm. longis latisque, ovario ovoideo glabrescente, tenello vix stellato-puberulo demum glabro, 2-cocco, stylis 2 integerrimis carnosiss epapillosis ad 8 mm. longis ad basim ipsissimam liberis.

COSTA RICA: Alajuela: Palmira, *Austin Smith* 2876.

This differs from *A. latifolia* Sw. in the styles being cleft to the base and in its foliage. The Central American species are much in need of a critical study.

Cleidion* Blume**Cleidion denticulatum* Standl. in Field Mus. Publ. Bot. 4: 218. 1929.**

The holotype, *Cooper* 12239, is poor. Its crowded malpighiaceous hairs and the large, easily separable bundles of the columella are strongly reminiscent of *Bernardia*. The loose seeds on the type-sheet, however, have the characters of *Cleidion*. Better material is needed to determine the correct generic position of this species.

***Cleidion oblongifolium* (Standl.) comb. nov.**

Alchornea oblongifolia Standl. in Carnegie Inst. Wash. Publ. 461: 66. 1935.

The ♀ flower ending the rachis of the inflorescence has manifestly cleft

styles, such as characterize *Cleidion*. The comparatively long and narrow leaves conform to those of this genus. If generic value is denied to the nature of the style, this being entire in *Alchornea*, and cleft in *Cleidion*, it becomes impossible to separate the two groups which both tradition and an aggregate of characters have rightly maintained as distinct genera. This plant is endemic to British Honduras.

***Cleidion prealtum* sp. nov.**

Arbor ad 30–35 m. alta, innovationibus parcius puberulis citissime glabratissimis vel glabris, cortice pallide brunneo sat lenticellato. Foliis 7–14 cm. longis, 2–5 cm. latis, obovato-oblongis vel ellipticis, apice breviter acuminatis, basi plus minusve rotundatis, junioribus membranaceis brunneis vel olivaceis, adultis (e folio singulo) forsan coriaceis, subtus pallidioribus, in venis leviter puberulis glabratissimis supra glabratissimis vel glabris secus costam hic inde pustulato-glandulosis, venis gracilibus ca. 6-jugis, petiolis herbaceis puberulis 2–4 cm. longis, stipulis setaceis ad 3–4 mm. longis. Inflorescentiis ♂ spicatis gracillimis 8–10 cm. longis, floribus in cymulis saepius paucifloris secus rhachem dissitis; perianthio subsessili 3- vel 4-lobo valde delicato puberulo ca. 3.5 mm. lato totidemque longo vel minore, staminibus ca. 50, antheris lateraliter dehiscentibus, filamentis ca. 2 mm. longis; pistillodio, glandulis nullis. Inflorescentiis ♀ spicis simplicibus ad 3 cm. longis, subtus bracteis ca. 2 vel 3, linearibus vel subsetaceis, 2 mm. longis, in axillis inferioribus semper flore evolutis carentibus, apice flore terminatis; perianthio ca. 3–4.5 mm. lato, lobis 5 vel 6 interdum 2 plus minusve inter se adnatis, lineari-lanceolatis, ad 2 mm. longis, basi etsi disco nullo tumido-saccatis; ovario ovoideo ca. 3 mm. longo et 2 mm. lato, luteo-tomentello, stylis 3 quove bipartito intus longe grosseque papilloso, papillis haud processiformibus.

BRAZIL: Amazonas: Municipality of Humayta, near Tres Casas, *Krukoff* 6458 ♀ (TYPE), 6357 ♂, 6391 ♂.

Also here probably belong *Krukoff* 6602, 6649, and 6570, all from the Municipality of Humayta near Livramento on the Rio Livramento. The material cited was distributed as representing *Alchornea hilariana* Baill. and *A. brachygyne* Pax & Hoffm., the misdeterminations being probably suggested by photographs illustrating plants with similar foliage. The ♀ flower and the leaves of *C. prealtum* are strongly reminiscent of *Epiprinus* Griff. from tropical Asia, a genus which stands out as a natural unit of few species but is otherwise closely allied with *Cleidion*.

***Cleidion Woodsonianum* sp. nov.**

Arbuscula 4–5-metralis, pilis brevissimis in innovationibus exceptis glabra. Foliis utrinque acuminatis ellipticis, 7–11 cm. longis, 1.5–4 cm. latis, apice breviter acuminato-caudatis, basi truncatis vel vix subauriculatis, hic inde in lamina ipsa glandulosis, pallide olivaceis, supra sub lente minute papilloso glabris, subtus pilis perpaucis exceptis glabris, margine serrato-denticulatis, venis adscendentibus utrinque ca. 7-jugis, petiolo 0.5–1.5 cm. longo. Inflorescentia ♂ ignota. Inflorescentia ♀ ad 15 cm. longa, gracillima, floribus 3 vel 4 tantum, bracteis minutissimis lineari-triangularibus fultis; perianthii lobis (videtur) 5 minimis lineari-subulatis, petalis glandulisque nullis, ovario puberulo ovoideo ca. 3 mm. longo totidemque lato, stylis 3 ca. 8 mm. longis quove fere ad basim partito; fructu capsulari, columella gracili delapsa ad 4–5 mm. longa, epicarpio

sublevi olivaceo sub lente puberulo, semine ovoideo subquadrangulo ca. 4 mm. magno apice acutato.

PANAMA: Canal Zone: Vicinity of the Salamanca Hydrographic Station, Río Pequeni, *Woodson, Allen & Seibert 1587*.

This suggests certain species of the Old World, such as *C. leptostachyum* Pax & Hoffm. from the Fiji Islands. The type-material was originally distributed with doubt as representing *Alchornea costaricensis* Pax & Hoffm.

Jatropha Linnaeus

Jatropha hippocastanifolia sp. nov.

Frutex fere metralis. Foliis fere ad basim partitis, 5-7-lobis, margine duplicato-dentatis vel denticulatis vel dentato-serratis longiuscule ciliato-glandulosis, pallide olivaceis utrinque pilis albidis simplicibus sat longis mollisque indutis, 15 cm. longis, 18 cm. latis, juvenilibus multo minoribus, lobo medio maximo cum lateralibus imbricante 12 cm. longo 6 cm. lato ca. 12-nervio, lobis caeteris minoribus externis ca. 4-5 cm. longis 2.5 cm. latis vel minoribus, petiolo herbaceo ad 17 cm. longo aequae ac lamina induto, hic inde glandulis fasciculatis capitulatisve ornato, basi stipulis glandulosis dissectis insignito. Inflorescentiis cymosis gracilibus velutinosi ad 15 cm. longis, bracteis longe piloso-glandulosis vix 1 cm. longis 2 mm. latis onustis. Floribus ♂ albo-hispidis pubescentibusve, sepalis ca. 2-3 mm. longis 1 mm. latis integris vel margine denticulis perpaucis glandulosis vel eglandulosis notatis, petalis atro-purpureis ca. 5 mm. longis 3 mm. latis basi abrupte coarctatis vel angustatis pilosulis, staminibus 10 in acie duplici filamentis breviter liberis demum in columnam connatis, submaturis ad 6 mm. longis, glandulis rotundatis discretis 5 oppositisepalis. Floribus ♀ ut ♂, sepalis semper neque raro tantum ciliato-glandulosis, ovario globuloso costulato hic inde pilis albidis simplicibus ornato, levi, ca. 2 mm. longo latoque, disco irregulariter interrupto subintegrove margine hic inde bilabiato vix 0.75 mm. alto, stylis pro more gracilibus glabris ad 2.5 mm. longis, stigmatibus primum partitis dein cruce quoque iterum 2- vel 3-lobulato.

PARAGUAY: Chaco Paraguayo: Oruro, *Rojas 8559*.

To discuss this new species with finality, a critical consideration should be given of several species, including *J. gossypifolia* L. My new species suggests the entity called *J. intercedens* by Pax but differs from it in three characters that, considered jointly, have specific significance. These characters are: (1) the style, which has bipartite, usually suberect stigmas in *J. gossypifolia* and its allies, has here spreading, 2- or 3-lobulate stigmas; (2) the foliage; the leaf-lobes of *J. hippocastanifolia* are much narrowed at the base and enlarged at the apex, the shape of the leaf being accordingly unlike that of *J. gossypifolia* and its allies; (3) the dark-purplish petals.

Jatropha Paxii nom. nov.

Jatropha flabellifolia Pax & Hoffm. in Pflanzenr. 42 (IV. 147): 52. 1910, non Steud. 1840.

A new name is needed, as *J. flabellifolia* Pax & Hoffm. is a later homonym of *J. flabellifolia* (Pohl) Steud., Nomencl. ed. 2, 1: 799. 1840.

Jatropha Hoffmanniae nom. nov.

Jatropha longipedunculata Pax & Hoffm. in Pflanzenr. 85 (IV. 147): 191. 1924, non Brandeg. 1920.

Brandegee's *J. longepedunculata*, in Univ. Cal. Publ. Bot. 7: 328. 1920, is a mere orthographic variant of *J. longipedunculata* Pax & Hoffm., which, consequently, is a later homonym.

Micrandra Bentham

Micrandra Benth. (1854) has been proposed for conservation by Mansfeld, in Kew Bull. 434. 1935, against *Micrandra* Benn. (1844).

***Microandra santanderensis* sp. nov.**

Arbor in sylvis primævis, innovationibus glabratis glabrisve. Foliis ellipticis apice plus minusve breviter acuminatis basi cuneato-rotundatis vel rotundatis firme chartaceis, 7–14 cm. longis, 2.5–6 cm. latis, brunneis vel obscure olivaceis, margine integris, totis graciliter nervosis, nervis utrinque ca. 8-jugis anastomosantibus obscuris, primo jugo adscendente caeteris latius patentibus, in axillis conferte penicillatis, petiolo 2–7 cm. longo, apice sub lamina glandulis 2 pustulosis ornato, stipulis triangularibus minimis. Inflorescentiis racemosis ut videtur polygamis ad 25–35 cm. longis. Floribus ♂: sepalis 5 puberulis triangulari-rotundatis vix 1 mm. longis, petalis 5 in sicco brunnescentibus quam sepalis duplo longioribus, staminibus ca. 5. Floribus ♀ post anthesim tantum visis, involucris floralibus illis ♂ (ut videtur) similibus, staminodiis ca. 5 setaceis nigricantibus, disco minimo parcissime glanduloso, ovario truncato-ovoideo ca. 3 mm. longo et 2 mm. lato, stylis in ovarium confluentibus brevissimis apice vix bilobis.

COLOMBIA: Santander: Vicinity of Puerto Berrio, between Carare and Magdalena Rivers, alt. 100–700 m., *Haught 2189* (TYPE); vicinity of Barranca Bermeja, Magdalena Valley, between Sogamoso and Carare Rivers, alt. 100–500 m., *Haught 2011*.

The two specimens here cited appear to differ at first on account of their differently colored foliage, but there are no floral or other differences. The conspicuous axillary tufts of hairs on the leaves of this new species are not found on *M. elata* Muell.-Arg., which is endemic to southern Brazil, or on *M. siphonioides* Benth., to judge from the photographs of the type-specimens which I have seen through the kindness of Mr. B. A. Krukoff.

Manihot Miller

***Manihot orinocensis* sp. nov.**

Specimen suppeditat valde mancum quam frustulum vix melius totum glaberrimum cortice tenello griseo subnitido elenticellato. Foliis pro more generis parvis ca. 6 cm. latis, 5–6 cm. longis, 3-lobatis, lobis margine integris revolutisve, mediano elliptico-lanceolato ca. 3 cm. longo et 1.5 cm. lato, lateralibus basi plus minusve anisophyllis caeterum lanceolatis, medio sat dilatatis, ca. 2.5–3 cm. longis et 1.5 cm. latis, subtus glaucescentibus, supra ruguloso-impressis, membranaceis, nervis ca. 8–10-jugis patentibus, petiolo ca. 2.5–3 cm. longo, stipulis ut videtur subnullis vel nullis. Perianthio ♂ primum inflato, in anthesi plena tubuloso ca. 10 cm. longo fere totidem lato pallido, lobis late lanceolatis ad 3 mm. longis, disco bene lobulato, staminibus ca. 5–7 mm. longis, plus minusve 10. Caetera desunt.

VENEZUELA: Amazonas: Upper Orinoco, Puerto Ayacucho, "a tree 4 m. high, growing on granitic rocks around Pto. Ayacucho," *Williams 13132*.

The type specimen, hardly better than a scrap, was sent by Mr. H. Pittier with the suggestion that the species may be new. I deferred its publication,

wishing to check it against material representing *M. saxicola* Lanj., the description of which suggested that it was uncomfortably close to the presumed new entity. *Stahel 107*, "cultivated from cuttings in the Agricultural Experiment Garden in Paramaribo, Surinam," identified at distribution as *M. saxicola*, is certainly not *M. orinocensis*, which differs in the texture and lobing of its leaves.

Tetrorchidium Poeppig

Poeppig & Endlicher are said to have published this genus in 1842 (see Pax & Hoffmann in Engl. & Prantl, *Nat. Pflanzenfam.* ed. 2. **19C**: 184. 1931), which is erroneous. The genus was actually published in 1845 by Poeppig alone, which is fully established by the title-page of the third volume of the *Nova Genera ac Species Plantarum* and associated data.

Tetrorchidium gorgonae sp. nov.

Arbuscula vel frutex 3–4 m. altus, innovationibus puberulis indumento brevissimo adpresso simplici demum glabrescentibus griseis. Foliis 10–22 cm. longis, 2.5–6.5 cm. latis, utrinque parce pubescentibus vel glabratibus, supra viridibus, subtus pallide viridibus subnitidis, oblanceolatis sat abrupte caudato-acuminatis obvie distanterque serrato-dentatis, dentibus subcallosis utrinque ca. 4 vel 5, nervis ascendentibus vel patulis utrinque ca. 6-jugis, sub margine anastomosatis, trabeculis conspicuis, petiolo 1–2 cm. longo apice utrinque glandulis baculiformibus luteis insignito parcius hispido; stipulis late triangularibus, vix ultra 1 mm. longis totidemque latis. Inflorescentia in fructu tantum visa gracili ad 5 cm. longa; perianthio sub-integro vix 2–2.5 mm. lato, pedicello ca. 2 mm. longo, columella acuminata ad 5 mm. longa, semine lenticulari ca. 5 mm. magno, testa nigra profundius lacunos-foveolata, in arillo sat tenui roseato immersa; epicarpio immaturo (ut videtur) levi.

COLOMBIA: Nariño: Island of Gorgona, *Killip & Garcia 33214* (TYPE in U. S. Nat. Herb.).

A very distinct species, with comparatively narrow, small leaves, their margins with sharp teeth. In these characters it may be at once distinguished from *T. macrophyllum* Muell.-Arg., *T. rubrivenium* Poepp., and the species next described.

Tetrorchidium boyacanum sp. nov.

Arbuscula glaberrima, innovationibus subherbaceis. Foliis utrinque viridibus, 9–12 cm. longis, 4.5–5.5 cm. latis, obovatis vel elliptico-obovatis, apice breviter apiculatis, basi longiuscule cuneatis, firme chartaceis, nervis utrinque 6- vel 7-jugis jugo basali valde adscendente caeteris plus minusve patulis sub margine obscure anastomosatis, laminae margine glandulis pustulosis paucioribus in quarto superno praesertim insignito quapropter folii apice primo intuitu plus minusve profunde dentato-serrato, petiolo canaliculato glandulis 2 pustulosis anticis ornato 1–1.5 cm. longo. Inflorescentia ♂ tantum visa, ad 15 cm. longa, gracili, ramosa, glaberrima; floribus ca. 3–6 in axilla bractee minutae utrinque glandulis luteis notata, calyce subsessili ca. 2.5 mm. lato, lobis 3 rotundato-ovatis subcucullatis ca. 1–1.5 mm. longis totidemque latis, staminibus 3, pistillodio (?).

COLOMBIA: Boyacá: El Umbo, 130 miles north of Bogotá, "in high thick forest, tree 12–16 ft., 4–6 inch. diam.," *Lawrance 547*.

This somewhat suggests *T. rubrivenium* Poepp., but it is altogether unlike that species in its leaf-margins.

***Tetrorchidium popayanense* sp. nov.**

Arbuscula videtur, innovationibus subherbaceis, strigulosis, indumento perbrevis luteo valde adpresso. Foliis pallide olivaceis, 16–23 cm. longis, 7–9 cm. latis, longe obovatis vel oblanceolato-ellipticis, apice breviter acuminatis, basi longe cuneatis, firme chartaceis subtus sub lente vix pubescentibus, supra glabratis vel glabris subnitidis, nervis manifestis ca. 7–9-jugis, inferioribus adscendentibus, superioribus patulis bene anastomosatis trabeculis inconspicuis, laminae margine integro revoluta utrinque glandulis tubulosis estipitatis brevibus 5 vel 6 ornato, petiolo valde canaliculato eglanduloso pubescente 2–3 cm. longo. Inflorescentia gracili pubescente 7–10 cm. longa parcius ramosa, ♂ tanto visa. Floribus subsolitariis, calyce ca. 2.5 mm. lato pubescente pedicello ca. 1.5–2 mm. longo fulto, lobis 3 ovato-acuminatis, ca. 1–1.25 mm. longis, 1 mm. basi latis, staminibus 3 oppositilobis sessilibus vel subsessilibus ligulam centram minutam (an pistillodium?) circumdantibus; bractea sub pedicello subtriangulari ca. 1.5 mm. lata glandulis insignita cum illis in lamina congruentibus.

COLOMBIA: El Cauca: Highlands of Popayán, (?) Río Huangubio, *Lehmann B7664*.

The type locality is not better indicated. The characters of the foliage suggest those of *T. euriphyllum* Standl. of Central America, but the primary nerves are less numerous and the leaf-blade is differently shaped, more markedly cuneate at the base, and with different marginal glands; the glands on the floral bracts are also different.

***Tetrorchidium jamaicense* sp. nov.**

Arbor ad 8 m. alta glaberrima. Foliis integris primum tenuiter membranaceis demum firme subcoriaceis ellipticis vel elliptico-obovatis, 7–12 cm. longis, 3–4.5 cm. latis, apice breviter rotundato-acuminatis, basi longe cuneatis olivaceis subconcoloribus, nervis in sicco gracilibus at conspicuis ca. 7-jugis adscendentibus, petiolo carnosulo 1–2.5 cm. longo utrinque glandulis cicatricosis ornato, stipulis minimis vel subnullis. Inflorescentia ♂ tantum visa more generis gracili, effusa glabra parcius ramosa ad 18 cm. longa; floribus glomerulatis ad 4–8, glomerulis sat distantibus (proximis in rhachi inferiore 1–2 cm. remotis), perianthio ca. 5 mm. lato, lobis 3 ellipticis vel obovato-ellipticis margine intus subplicatis, staminibus sessilibus 3(–4), antheris more generis sat magnis.

JAMAICA: Road to Holly Mount, *Harris 8991*.

This new species is certainly the plant which Fawcett & Rendle (Fl. Jam. 4(2): 317. f. 105. 1920) and Pax & Hoffmann (in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19C: 186. 1931) identify as representing *T. rubrivenium* Poepp. It differs from Poeppig's species, however, as represented by *Poeppig 1915* and *Klug 3713*, in having glabrous inflorescences, elliptic rather than triangular perianth-lobes, and entire leaves which are more coriaceous.

***Sapium* P. Browne**

***Sapium Bourgeau* sp. nov.**

Arbor vel frutex glaberrimus. Foliis ellipticis, apice recurvatim glandu-

loso-cucullatis utrinque fere aequo jure rotundato-acuminatis, supra obscure subtus pallide olivaceis, margine sat conferte aristato-serratis, aristulis nigricantibus marcescentibus, hic inde glandulis pustulosis ornatis, ca. 15 cm. longis, 3–4 cm. latis, nervis delicatis at perspicuis latius adscendentibus ca. 15-jugis, petiolo 3–4 cm. longo apice glandulis 2 patentibus conicis onusto, stipulis late rotundato-auriculatis margine valde coriaceo-scariosis. Capsulae coccis delapsis (an revera hujus loci? soluti tantum adsunt) duris, ca. 10 mm. longis, semine arillo secedibili rubro induto ca. 7 mm. longo latoque.

MEXICO: Veracruz: Orizaba, Santa Aña, *Bourgeau* 3020.

This collection is mentioned by Hemsley in the notes under *S. mexicanum*, in Hook. Ic. **27**: sub *pl.* 2680, p. 2. 1901. Hemsley states that it is neither that species nor *S. lateriflorum* Hemsl. It is certainly not *S. macrocarpum* Muell.-Arg. (*S. mexicanum* Hemsl.), *S. appendiculatum* Pax & Hoffm., or *S. pedicellatum* Huber. The reflexed glandular tip of the leaf is a distinctive character.

***Sapium Cuatrecasasii* sp. nov.**

Arbor magna, innovationibus cicatricosis glabris saltem sub apice stipulis cucullato-glandulosis magnis ornatis. Foliis 7–15 cm. longis, 2.5–5.5 cm. latis, subcoriaceis, apice fere planis vix emarginatis, venulosis, supra pallide olivaceis, subtus brunneo-lutescentibus, ellipticis utrinque sat obtuse acuminatis glaberrimis, margine totis crenato-glandulosis crenis haud profundis glandulis marginalibus hic inde obviis, nervis gracilibus patentibus saepius haud anastomosantibus utrinque ca. 20 ultimis vix perspicuis, petiolo rigidulo 2.5–4 cm. longo glandulis 2 vel 3 conicis anticis insignito. Inflorescentia spicata 2-sexuali sat crassa. Floribus ♂ ca. 12 in axilla squamulae cujusvis glandula utrinque valde carnosa ad 4–5 mm. longa, perianthio longe campanulato ca. 2–3 mm. longo et 2 mm. lato, lobo antico apiculato, staminibus 2 ad 3 mm. longis. Floribus ♀ in anthesi ignotis submaturis ad 10 mm. longis 5 mm. latis, ovario glaberrimo nigro ovoideo stylorum cicatrice subproducta notato, perianthii lobis 3 ovatis subscariosis intus medio crasse costatis, glandula utrinque ellipsoidea sat magna.

COLOMBIA: Putumayo: Valle de Sibundoy, alt. 2200 m., *Cuatrecasas* 11671.

This does not agree with any other species known to me from the region. The comparatively short petioles, the robust spikes, and the produced scars left by the fallen style on the ovaries are characteristic.

***Sapium myrmecophilum* sp. nov.**

Arbuscula semimetralis. Foliis 5–8 cm. longis, 1–3 cm. latis, ellipticis subcoriaceis, apice subplanis vel retusis, utrinque brevius acuminatis, obscure conferteque crenulatis raro hic inde glandulosis, nervis patentibus ca. 15-jugis, petiolo vix 1 cm. longo vel minore glandulis 2 conicis patentibus pustulosis, stipulis auriculatis. Inflorescentia spicata bisexuali ad 10–15 cm. longa. Floribus ♂ ca. 9 vel 10 in axilla bracteolae latae parvae, perianthio aperiente vix 1–1.5 mm. longo, staminibus 2. Floribus ♀ subsessilibus in anthesi haud visis: perianthii lobis scariosis (videtur) 3, ovario maturescente globuloso depresso ca. 0.5 cm. magno, apice cicatrice minima haud producta notato.

COLOMBIA: El Vichada: 60 km. south of Orocué, *Haught* 2772.

This is described as a spreading shrub growing on ant-hills in the open llanos. It is characterized by the close leaf-crenation and the very short petioles.

Sapium Poeppigii Hemsl. in Hook. Ic. **27**: pl. 2678. 1901; Huber in Bull. Herb. Boiss. II. **6**: 439. f. 32. 1906.

Sapium hamatum (Muell.-Arg.) Pax & Hoffm. in Pflanzenr. 52 (IV. **147**. v): 229. fig. 43 D,E. 1912. Syn. Nov.

Sapium biglandulosum var. *hamatum* Muell.-Arg. in Linnaea **32**: 116. 1863.

PERU: Huánuco: Between Huánuco and Pampayacu, *Kanehira* 12; Pampayacu, *Kanehira* 28; San Martín: Zepelacio, *Klug* 3374; Loreto: Lower Río Huallága, *Williams* 4771.

This is another of the entities which have been confused under the loosely applied name *S. Hippomane*. The identifications are made on the strength of the illustrations and the descriptions. The leaves are longer, narrower and thinner than are those of *S. Marmieri*. A specimen from Colombia, collected by Cuatrecasas along the Río Guamues, Putumayo, may belong here, but it lacks ♀ flowers and fruits. Pax & Hoffmann err in replacing *S. Poeppigii* Hemsl. (1901) by *S. hamatum* (Muell.-Arg.) Pax & Hoffm. (1912). The name which is published first in a given rank has priority, and cannot be replaced by a later combination even though the basynym, in this case a trinomial, happens to be the oldest name.

Sapium aereum Kl. ex Muell.-Arg. in Linnaea **32**: 119. 1863; Pax & Hoffm. in Pflanzenr. 52 (IV. **147**. v): 233. 1912.

BRAZIL: Amazonas: Humayta, *Krukoff* 6158, 6296, 6307; São Paulo de Olivença, *Krukoff* 8311.

This is an exceptionally critical entity which it would be desirable to compare with Klotzsch's own specimen. Only the last of the collections cited was distributed as *S. aereum*, all others being referred to *S. Hippomane*. While it seems quite likely that *S. glandulosum* (L.) Morong (*S. Hippomane* G. F. W. Mey. et auct.) and *S. aereum* are close, they appear to differ in the texture of the leaf and, to judge from the fruits of *Pittier* 11832 and *Krukoff* 8311, also in the fruit, this being possibly larger in *S. aereum* and somewhat differently shaped. In a very definite sense *S. aereum* connects *S. glandulosum* and *S. Marmieri*, differing from the latter primarily in its leaves on the whole being smaller and narrower. Good fruiting material is essential to a final elaboration of all these entities.

The vernacular name "Tapuru" appears on the label of *Krukoff* 6158. A specimen which might belong here and strongly suggests the characters described and illustrated for *S. Taburu* Ule (in Tropenfl. **9**: Beih. 6:13. fig. 3 D, E. 1905) is *Klug* 1668, Colombia, Putumayo, Umbría. I strongly suspect that eventually it may be shown that *S. aereum* and *S. Taburu* are uncomfortably close if not identical. Pax & Hoffmann express the belief, Pflanzenr. 52 (IV. **147**. v): 232. 1912, that *S. Taburu* is hardly separable from the entity they identify as *S. Hippomane*. In my opinion, this is the result of the two authors lacking a clear understanding of the ranges of these species. Unquestionably, a great simplification of the taxonomy of this group follows if *S. glandulosum* (*S. Hippomane*) is excluded from the Amazonian ranges of Brazil, Colombia and Peru.

Sapium Marmieri Huber in Bol. Mus. Goeldi **3**: 367. 1902, in Bull. Herb. Boiss. II. **6**: 354. 1906; Pax & Hoffm. in Pflanzenr. 52 (IV. **147**. v): 256. 1912.

Sapium Leitera Gleason in Bull. Torrey Club **60**: 364. 1933. Syn. Nov.

PERU: Loreto: Alto Río Itaya, *Williams* 3490; Lower Río Huallága, *Williams* 4904, *Killip & Smith* 29265. BRAZIL: Matto Grosso: source of the Jatuarana River, *Krukoff* 1656 (type collection of *S. Leitera* Gleason); Acre: Río Purus, *Krukoff* 5717; Amazonas: São Paulo de Olivença, *Krukoff* 8098, 8428. COLOMBIA: Putumayo: Puerto Ospina, *Cuatrecasas* 10784; Tolima: Curvas de Gualanday (Ibagué-Girardot), *Pérez-Arbeláez & Cuatrecasas* 6490.

This species is of economic importance as a potential source of rubber, for which it has been tapped in the past. The type was collected in the region of the Río Ucayali and the Río Huallága in Amazonian Peru. I match the descriptions with *Williams* 3490 and 4904, which I accept as representing this species. The leaf is essentially oblong to elliptic and more or less obtusely rounded at the tip in these two specimens which, once again to judge from the descriptions and the figures (see for instance Hemsley in Hook. Ic. **29**: pl. 2899. 1909), can hardly be separated from *S. eglandulosum* Ule in Tropenfl. **9**: Beih. 6: 14. 1905. The foliage of *Killip & Smith* 29265 differs from that of the *Williams* specimens in being distinctly rounded to short round-elliptic, with the tip of the blade often retuse, but the remaining characters agree so well that, the range being in common, it must be considered that all these specimens are conspecific. As is well-known, considerable foliar differences are apt to occur in the same species of *Sapium* depending upon conditions of growth.

All the collections cited from Brazil have leaves that tend to match those of *Killip & Smith* 29265, but leaves of a pattern intermediate between those of this specimen and the *Williams* material are present in *Krukoff* 8428. The Colombian collections well match those from Peru, the record from Tolima being interesting as an extension of the range, heretofore supposedly restricted to the Andean regions of Peru, Brazil, and Colombia. *Sapium utile* Preuss, to judge from Hemsley's plate (in Hook. Ic. **29**: pl. 2896. 1909), is represented in our herbarium by a *Lehmann* specimen from Colombia, forests of Chocó-Micay and Timbiquí, which differs from *S. Marmieri* in the more or less evidently serrulate leaf-margins as well as its longer and narrower leaves. It is altogether likely that the records of *S. Hippomane* from Peru, Brazil, and Colombia are based to a large extent on misdeterminations of *S. Marmieri* and its allies.

Sapium aucuparium Jacq. Enum. Pl. Carib. 31. 1760, p. p. typ., excl. syn. Plumier.

Sapium jamaicense Sw. Adn. Bot. 62. 1829. Syn. Nov.

Jacquin's binomial has been extensively misapplied, the discussion of Hemsley, in Hook. Ic. **27**: pl. 2650. 1901, and the treatment of Pax & Hoffmann, in Pflanzenr. 52 (IV. **147**. v): 229. 1912, merely adding to the confusion.

The original publication reads as follows: "*aucuparium*. I. SAPIUM. Plum. ic. 171. f. 2. Brown. Jam. 1. p. 338.," the generic name being followed by the conventional abbreviation to designate a woody perennial. At the time when this publication was issued, one of its synonyms, "Plum. ic. 171.

f. 2.," had already been cited by Linnaeus under *Hippomane glandulosa*, Sp. Pl. 1191. 1753, which leaves Jacquin's binomial standing solely upon Browne's "*Sapium* 1. *Arboreum foliis ellipticis glabris, petiolis biglandulis, floribus spicatis.*" (Hist. Jam. 338. 1756). This synonym has been overlooked by most authors, but not by Fawcett & Rendle, Fl. Jam. 4 (2): 325. 1920, who place it in the synonymy of *S. jamaicense* Sw. This binomial, consequently, falls under *S. aucuparium* Jacq.

Three years after the publication of *S. aucuparium*, as quoted, Jacquin again dealt with the same binomial, Select. Amer. Hist. 249. *pl.* 158. 1763, repeating the original references but adding *Hippomane glandulosa* Linn. and Plukenet's "*Tithymalus arbor americana, mali medicae folio . . .*" Jacquin's illustration and description here apply to a very different plant than the one he identified in 1760 as *S. aucuparium*. Naturally, this plant cannot bear the binomial which was misapplied to it by Jacquin and very numerous other authors. I discuss it as *S. biglandulosum* (L.) Muell.-Arg. below.

***Sapium biglandulosum* (L.) Muell.-Arg. in Linnaea 32: 116. 1863, excl. var. fere omn.**

Hippomane biglandulosa L. Sp. Pl. ed. 2. 1431. 1763, p. p. typ., quoad syn. Jacq.

Sapium aucuparium Jacq. Select. Amer. Hist. 249. *pl.* 158. 1763, quoad ic. descr. excl. syn. omn., non *S. aucuparium* Jacq. Enum. Pl. Carib. 31. 1760.

Sapium salicifolium H. B. K. Nov. Gen. & Sp. 2: 52. 1817. Syn. Nov.

Sapium Moritzianum Kl. in Seem. Bot. Voy. Herald 100. 1852; Huber in Bull. Herb. Boiss. II. 6: 358. f. 19. 1906; Pax & Hoffm. in Pflanzenz. 52 (IV. 147. v): 230. 1912. Syn. Nov.

PANAMA: Coclé: El Valle de Antón, Las Uvas, Allen 2575; Perlas Islands, Pedro Gonzales, Allen 2583. COLOMBIA: Magdalena: Santa Marta, H. H. Smith 1916; Boyacá: Orocué, Haught 2826. VENEZUELA: Aragua: Carbachito, Pittier 11802; Cagua, Pittier 12291; Distrito Federal: Cotiza, Pittier 12401.

Linnaeus is the author of both *Hippomane glandulosa*, 1753, and *Hippomane biglandulosa*, 1763. Although the latter epithet might have been mistakenly applied for the former, it proves impossible to treat it as a clear unintentional error under the current Rules of Nomenclature, particularly so in that it has been extensively used in botanical literature under different generic names. The correct application of *S. glandulosum* (L.) Morong is discussed below.

The original publication of *H. biglandulosa* reads as follows: "*Hippomane biglandulosa* foliis ovato-oblongis basi biglandulosis. *Sapium arboreum, foliis ellipticis glabris, petiolis biglandulis, floribus spicatis.* Brown. jam. 338. *Sapium aucuparium.* Jacq. amer. 31. t. 158. *Mancanilla lauri* foliis oblongis. Plum. gen. 50. ic. 171. f. 2. *Tithymalus arbor americana, mali medicae foliis amplioribus tenuissime crenatis succo maxime venenoso.* Pluk. alm. 369. t. 229. f. 8. *Habitat in America calidiore.*" The synonyms from Browne, Plumier, and Plukenet are discussed under *S. glandulosum* and *S. aucuparium*, to which they belong. Since no specimen of *H. glandulosa* or *H. biglandulosa* is extant in the Linnaean herbarium (see Jacks. Ind. Linn. Herb. 86. 1912), *H. biglandulosa* rests solely upon the plate and description of *S. aucuparium* Jacq., 1763 non 1760. It is fortunate that

Jacquin's misapplication can easily be corrected by the reinstatement of *S. biglandulosum* (L.) Muell.-Arg. in the sense here proposed.

Mueller-Argoviensis followed *S. biglandulosum* with a trinomial α *Meyerianum*, essentially based upon Meyer's *S. Hippomane*. This is taxonomically not correct, but, as is well-known, a new combination stands (Art. 54, Amsterdam Rules 1935) even if it involves a misapplied specimen. Accordingly, the type of *S. biglandulosum* is the plant figured by Jacquin, growing near Cartagena in Colombia, "inque ipso suburbio Xiximani ante macellum." The type-variety, on the contrary, is *S. biglandulosum* var. *Meyerianum*.

Sapium salicifolium H. B. K. has generally been treated as a doubtful synonym of *S. Moritzianum*. The type material was collected at Morales on the banks of the Río Magdalena, and is without ♀ flowers or fruits. Its description so closely agrees with the material I have seen that I do not hesitate to accept it as representing *S. biglandulosum*. The existence of some varieties under this binomial is likely. The Venezuelan plant, for instance, would seem to have slightly different leaves on the whole, as noted by Huber, in Bull. Herb. Boiss. II. 6: 358. 1906, in his discussion of *S. aucuparium*.

Sapium glandulosum (L.) Morong in Britt. & Mor. in Ann. N. Y. Acad. Sci. 7: 227. 1893.

Hippomane glandulosa L. Sp. Pl. 1191. 1753, p. p. typ., quoad syn. Pluk., Raj.

Sapium Hippomane G. F. W. Mey. Prim. Fl. Esseq. 275. 1818; Huber in Bull. Herb. Boiss. II. 6: 360. f. 21. 1906; Pax & Hoffm. in Pflanzenr. 52 (IV. 147. v): 231. 1912, p. p. Syn. Nov.

Sapium suberosum Muell.-Arg. in Linnaea 34: 217. 1865; Hemsl. in Hook. Ic. 27: pl. 2650. 1900. Syn. Nov.

Sapium Hemsleyanum Huber in Bull. Herb. Boiss. II. 6: 362. f. 22. 1906. Syn. Nov.

BARBADOS: Forester's Hall Wood, Eggers 7238. VENEZUELA: Distrito Federal: Naigutá, Pittier 11832.

Hippomane glandulosa L. rests exclusively upon two synonyms, "Mancanilla lauri foliis oblongis. Plum. gen. 50" and "Tithymalus arbor americana, mali medicae foliis amplioribus tenuissime crenatis, succo maxime venoso. Pluk. alm 369. t. 229. f. 8. Raj. suppl. 428." Urban used one of these polynomials, Plumier's *Mancanilla*, in the synonymy of his own *S. caribeum*, Symb. Ant. 3: 309. 1902, and referred the other, op. cit. 306, to *S. Hippomane* G. F. W. Meyer. *Sapium Hippomane* Meyer was a new name for *Hippomane biglandulosa* L., the Linnaean binomial being cited by Meyer under his own.

Under the current Rules, the correct transfer of *Hippomane biglandulosa* to *Sapium* can be effected only by publishing *S. biglandulosum*, which was done by Mueller-Argoviensis but not by Meyer. Meyer's name, consequently, is illegitimate, and falls now under *S. glandulosum* (L.) Morong, which is typified by Plukenet's *Tithymalus* as interpreted by Urban. Here also belong *S. suberosum* Muell.-Arg., based on a diseased condition of the entity under discussion. Huber comments that the entities he understands as *S. Hemsleyanum* and *S. Hippomane* are not certainly distinct as species, but might easily prove to be varieties. This is possible, but the material

I have seen so far is too scanty to justify the publication of trinomials in this difficult group; *Eggers* 7238, from Barbados, cited by Pax & Hoffmann, is certainly very close to *Pittier* 11832 from the coast of Venezuela.

I cannot follow Pax & Hoffmann in accepting *S. glandulosum* (which they call *S. Hippomane*) for the Amazonian forms of Brazil and Peru. Everything indicates that Pax & Hoffmann confuse *S. glandulosum* with *S. Marmieri*. The former would seem to have an essentially coastal range, restricted to the Guianas, Venezuela, and some of the West Indian islands, while the latter, as noticed elsewhere in this paper, is primarily an Amazonian type.

Index Kewensis lists *S. glandulosum* Morong as an error for *S. biglandulosum* Muell.-Arg. and accepts as valid the combination of Druce in Rep. Bot. Exch. Club Brit. Isl. 1913, **3**: 423. 1914. I cannot accept this interpretation. It is true that Morong treats *H. glandulosa* and *H. biglandulosa* as synonymous, but the combination he made conforms with the requirements of Art. 44[2] of the current Rules of Nomenclature in being followed by a full reference to *Hippomane glandulosa* L.; the remaining two citations can be excluded as misapplications without affecting in the slightest the validity of the new combination. The fact that Morong's transfer was effected for a misapplied specimen does not make this transfer illegitimate.

I have not seen authentic material of *S. obtusilobum* Muell.-Arg., but Huber's illustration, in Bull. Herb. Boiss. II. **6**: 357. f. 17. 1906, suggests that this species might fall here as a trinomial if not as a straight synonym.

Sebastiania Sprengel

Sebastiania huallagensis sp. nov.

Arbuscula ca. 6-metralis innovationibus glaberrimis. Foliis elliptico-lanceolatis, apice sat abrupte acuminatis, basi cuneatis, margine integris, 6–9 cm. longis, 2.5–3.5 cm. latis, nervis gracilibus ca. 10–14-jugis, petiolo ca. 1.5 cm. longo apice glandulis 2 nigricantibus pustulosis sat magnis ornato. Inflorescentia gracili bisexuali ad 8 cm. longa. Floribus ♂ ca. 6–8 in axilla squamulae ca. 1.5 mm. lata, perianthio minuto subsessili 3-lobato, staminibus alternilobis 3 basi connatis. Floribus ♀ singulis pedicello ca. 0.5 cm. longo, ovario levissimo ca. 4 mm. longo et 1.5 mm. lato, basi squamis imbricatis 3–5 circumdato, in stylis 2–3 crassiusculis divergentibus abeunte.

PERU: San Martín: Juan Jui, Alto Río Huallága, *Klug* 4243.

Distributed as representing *Alchornea* sp. ?, which it is certainly not. The sum of the characters suggests *Sebastiania*, but better material is needed to confirm this disposition of it.

Sebastiania anisandra (Griseb.) Lillo in Seg. Contr. Conoc. Arbol. Argent. 16. 1917.

Actinostemon anisandrus Pax in Pflanzenr. 52 (IV. **147**. v): 79. 1912.

Dactylostemon anisandrus Griseb. in Abh. Ges. Wiss. Götting. **24**: 61. 1879.

PARAGUAY: Alto Paraguay: San Lázaro, *Rojas* 5490.

The *Rojas* specimen, collected "entre rocas calcáreas semi-sombrias," is a good match for an Argentine specimen, *Venturi* 1350, from Tucumán,

Famaillá, originally distributed as representing *S. anisandra*. A younger state of the same species is apparently represented by *Venturi 5349*, identified by Lillo himself. This record seems to be a new one for the flora of Paraguay.

Euphorbia Linnaeus (excl. Chamaesyce)

Euphorbia insulana Vell. Fl. Flum. 5: pl. 14. 1827; Muell.-Arg. in Mart. Fl. Bras. 11(2): 688. 1874.

Euphorbia insulana minor Muell.-Arg. op. cit. 689. Syn. Nov.

Euphorbia anomala Salzm. ex Boiss. in DC. Prodr. 15(2): 59. 1862; Boiss. Ic. Euph. 15. pl. 38. 1866.

This is a widespread species, very close to *E. lancifolia* Schlect. of Mexico and Central America. It is convenient to break it up in three subspecies with a broad geographical background.

Euphorbia insulana subsp. **typica** subsp. nov.

Cyathii ca. 2.5 mm. longis, inflorescentiis saepissime abbreviatis bracteis subfoliaceis.

BRAZIL: Ceará: Maranguapé, *Drouet 2594*; Paraná: Guaratuba, *Dusén 13518*; São Paulo: Ilha Queimada, *Gehrt 4579*.

The type is Vellozo's figure. *Gehrt 4579* is altogether true to Mueller's description of *minor*, but impresses me as having been taken from a weak shoot of the plant.

Euphorbia insulana subsp. **tovarensis** (Boiss.) comb. nov.

Euphorbia towarensis Boiss. Cent. Euph. 19. 1860; in DC. Prodr. 15(2): 59. 1862.

COLOMBIA: Santander: Between El Roble and Tona, *Killip & Smith 19427*.

This trinomial is very near *E. lancifolia*, resembling it in the rather diffuse and robust inflorescence and in the comparatively large cyathia. *Bang 2208*, collected at an unrecorded locality in Bolivia, also belongs here; this specimen is erroneously listed as *E. geniculata* in Bull. N. Y. Bot. Gard. 4: 441. 1907.

Euphorbia insulana subsp. **pilcomayensis** subsp. nov.

A formis totis foliis bractealibus discedit saepius longe ellipticis, cyathii minoribus, inflorescentiis magis delicatis.

PARAGUAY: Pilcomayo River, *Morong 867* (TYPE); Between Río Apa and Río Aquidabán, *Fiebrig 4393*. ARGENTINA: Formosa, (?) *Jørgensen 3081*; Chaco (Argentina ?): Fontana, *Meyer 2320*.

The habit sets this new subspecies rather sharply apart from the others, but a broad concept of specific limits, necessary in this case, forbids its being treated as a full-fledged species. *Euphorbia Mandoniana* Boiss., of which I have seen only the meagerest scraps, may prove to be an extreme alpine form of this complex.

Euphorbia Huanchahana (Kl. & Garcke) Boiss. in DC. Prodr. 15(2): 103. 1862.

Tithymalus huanchahanus Kl. & Garcke in Abhandl. Akad. Wiss. Berlin 71. 1860.

As in many species of this genus in the South American range, it proves to be impossible to adopt for this entity a narrow concept of specific limits. The material I have at hand indicates the existence of two main aggregates, one localized in Peru, the other in southern Bolivia and northern

Argentina. In addition, the aggregate of Peru and Bolivia is divided into two forms, one glabrous, the other rather pubescent, which bear to each other a varietal relationship.

Euphorbia Huanchahana subsp. **typica** subsp. nov.

Foliis minutis saepissime margine serratis glabris.

I have seen a photograph of the type, collected in "Canta Prov. Peru." This material is to all appearances well matched by a Peruvian specimen from Matucana, Dept. Lima, *Savatier 1356*.

Euphorbia Huanchahana subsp. **penazuensis** subsp. nov.

Foliis carnosulis margine integris subintegrisve indumento sat conferto a subsp. *typica* discedit.

ARGENTINA: Tucumán: Sierra Calchaquies, Peñas Azules, 3400 m., *Burkart 5306* (TYPE); Catamarca: Andalgala, Cerro Negro, alt. 3500 m., *Jørgensen 1232*.

The habit is that of an alpine plant, the branches being rosulate and the rootstock much thickened.

Euphorbia Huanchahana var. **peperomioides** var. nov.

Pusilla, plus minusve rosulata a subsp. *penazuensis*, cujus est, quamque notis caeteris totis optime convenit glabritie primo intuitu recedit.

BOLIVIA: *Mandon 1068*.

This variety belongs to subsp. *penazuensis*, with which it agrees in habit and foliage, differing only in indumentum. The Mandon material I have seen is probably identical with the Weddell specimen from Bolivia cited by Boissier.

Euphorbia caespitosa Lam. Enc. Méth. **2**: 421. 1788; Boiss. in DC. Prodr. **15**(2): 103. 1862; Muell.-Arg. in Mart. Fl. Bras. **11**(2): 701. 1874.

This species is closely allied to *E. portulacoides* L. emend. Spreng., which ranges throughout Argentina and Chile. It is restricted in its range to the regions immediately adjacent to the mouth of the Río de la Plata in Uruguay and Argentina. It falls into two readily separable groups.

Euphorbia caespitosa subsp. **typica** subsp. nov.

Foliis obovato-ellipticis vel spatulatis, apice rotundatis.

URUGUAY: Vicinity of Montevideo, *Fruchard 182*, *Arechevaleta 5194a*.

The cited material agrees perfectly with Lamarck's type in the herbarium of the Paris Museum.

Euphorbia caespitosa subsp. **ventanicola** subsp. nov.

Cum subsp. *typica* in floralibus optime convenit, sed foliis apice bene acuminatis, loco natali alieno primo intuitu distincta.

ARGENTINA: Buenos Aires: Cerro Naposta, Sierra de la Ventana, *Von Rentszell 1082* (TYPE); Pigüé, *Burkart 4706*.

This is a well-marked form, readily recognizable by the characters of the foliage and by the range, which centers in the Sierra de la Ventana. It is likely that this plant is included in part by Boissier in his concept of *E. portulacoides acutifolia* Boiss., in DC. Prodr. **15**(2): 103. 1862, and is the one not altogether correctly identified as *E. caespitosa* by Spegazzini, Contr. Fl. Sierra Vent. 54. 1896; Contr. Fl. Tandil 47. 1901. *E. portula-*

codes Spr. [sic] *normalis* O. Ktze. is based upon a plant collected in the Tandil, O. Kuntze, Rev. Gen. **3**: 286. 1898, which I have not seen but which most likely belongs here. This trinomial is validly published and must be used for the typical form of *E. portulacoides* L. emend. Spreng., despite Kuntze's probable misapplication.

Euphorbia sciadophila Boiss. in DC. Prodr. **15**(2): 57. 1862; Muell.-Arg. in Mart. Fl. Bras. **11**(2): 687. pl. 97. 1874.

ARGENTINA: Tucumán: La Criolla, *Rodriguez* 502.

This species is common in southeastern Brazil and in Paraguay, but I have seen only the specimen cited from Argentina. The record seems to be new. The affinities of *E. sciadophila* with the Peruvian *E. adianthoides* Lam. require careful study.

Euphorbia spathulata Lam. Enc. Méth. **2**: 428. 1788; Boiss. in DC. Prodr. **15**(2): 136. 1862; Muell.-Arg. in Mart. Fl. Bras. **11**(2): 701. 1874; Croiz. in *Torreyia* **42**: 16. 1942, *in nota*.

Euphorbia dictyosperma Fisch. & Mey. in Ind. Sem. Hort. Petrop. **2**: 37. 1836; Boiss. in DC. Prodr. **15**(2): 135. 1862; Nort. in Missouri Bot. Gard. Rept. **11**: 106. pl. 22, 23. 1900; Wheeler in Kearn. & Peebl. Fl. Pl. Arizona 539. 1942. Syn. Nov.

The suspicion I have already voiced that *E. spathulata* is merely an introduced weed in the regions of the La Plata and that it is the same as *E. dictyosperma* Fisch. & Mey. of the southeastern United States is confirmed. No differences can be found to separate such specimens, for instance, as *Culwell & Timmons* 3065 (Central North Texas) and *Lombardo* 3903 (Montevideo), *Scala* 90, and *Burkart* 3747 (Mouth of the Paraná).

Euphorbia invaginata sp. nov.

Herbacea, glabra, caulibus fistulosis striatis hic inde ceraceis. Foliis carnosulis ligulatis vel longius elliptico-obovatis subeveniis, margine integris, apice mucronatis, basi longe acuminatis, epetiolatis, 5–6 cm. longis, 1–1.75 cm. latis, nervo medio validiusculo, stipulis petiolaribus subnullis vel nullis. Inflorescentiis terminalibus effusis ad 15 cm. longis bracteato-vaginatibus, primo internodio ad 4 cm. longo caeteris 0.75–1 cm. tantum longis, bracteis subpetaloideis pallidis hic inde albicantibus tenuissimis venulosis late ovato-cordatis ad 2 cm. longis totidemque latis mucronulatis. Cyathiis verosimiliter singulis bracteis occultatis invaginatibusque, ad 4 mm. longis et 2 mm. latis, cylindrico-campanulatis, nectariis 4 vel 5 stipitatis carnosulis margine corrugatis parvis appendice petaloidea nulla, pedicello ca. 1.5–2 mm. longo; capsula glabra levi, coccis delapsis ad 7 mm. longis angustis, semine valde elongato angusto ambitu tetragono, vix 1.5 mm. crasso, 6 mm. longo, arillo albicante hic inde granulato-leproso, caruncula rotundata bene umbonata stipitataque.

PARAGUAY: Chaco: Picuyba, *Rojas* 7268.

This new species belongs to Boissier's Sect. *Stachydium*, which includes *E. comosa* Vell., *E. lupulina* Boiss., *E. Gollmeriana* Boiss., *E. foliiflua* Ule, and the African *E. phylloclada* Boiss. From all the American species *E. invaginata* differs in the length of the seed. In foliage it most closely resembles *E. Gollmeriana* Boiss. and *E. foliiflua* Ule.

Euphorbia aureocincta sp. nov.

Herbacea hirta fistulosa, serius glabrata. Foliis (ut videtur) miro modo ludentibus, nunc more *Amaranthi* ssp. obcuneatis vel grosse quadrangulis, margine profundius irregulariter lobulato-dentatis, 3–6 cm. longis, 2–3 cm. latis, tum exquisite elliptico-lanceolatis margine integris 5–12 cm. longis 0.5–1.5 cm. latis, apice acutis, basi breviter cuneato-angustatis, petiolo semper brevi vix 1.5 cm. longo hirtulo. Inflorescentiis coarctato-capitulatis, bracteis lineari-lanceolatis acutis, 3–7 cm. longis, 0.5–1 cm. latis, integerimis, basi pulchre aureis; cyathio ca. 3 mm. longo fauce 2.5–3.5 mm. lato, lobis lacerato-ciliatis, nectario unico sat plano, ovario in anthesi subincluso, capsula depresso rotundato-trigona ca. 5 mm. longa et lata, stylis vix 1.5 mm. longis ad tertium inferum partitis; semine 3.5 mm. longo, 2 mm. lato, quadrangulo, arillo albicante vel pallide brunneo toto induto, basi truncato, apice longiuscule acuminato, sub apicem atque ad medium leviter constricto-zonato, hic inde verruculoso-lineato.

PARAGUAY: Carapeguá, Callistro, *Rojas* 3379 (TYPE). ARGENTINA: Jujuy: Quebrada del Chañi, *Schreiter* 10990.

This is a well-marked form, but its ultimate rank, whether binomial or trinomial, is a matter of speculation. It belongs to the group of *E. elliptica* Lam. (*E. geniculata* Ort.; *E. prunifolia* Jacq.), and its taxonomic status would seem to match exactly that of *E. zonosperma* Muell.-Arg. Unlike that species, which is widely distributed, *E. aureocincta* appears to be restricted to Paraguay, Argentina, and possibly Bolivia. The Schreiter specimen cited above requires verification, for it represents a state with leaves of amaranthoid pattern not resembling, at a glance, the typical form. *Rojas* 3379, which has only narrowly lanceolate leaves. However, both in *Rojas* 3379 and *Schreiter* 10990 the floral parts are identical, and some of the leaves are very similar. *Euphorbia heterophylla* L. β *elliptica* f. *hirticaulis* O. Kuntze, Rev. Gen. **3**: 286. 1891, probably belongs here.

Euphorbia acerensis Boiss. in DC. Prodr. **15**(2): 55. 1862.

ARGENTINA: Tucumán: Villa Lujan, *Venturi* 524 (? 324); Salta: Río Toro y Río Blanco, *Vattuone* 17.

The cited material was misdetermined as representing *E. adianthoides* Lam. All the species in this group are closely related, and the existence of intermediates between *E. acerensis* Boiss. and *E. Poeppigi* Boiss., which ranges from the Amazonian regions of Peru to Bolivia, is probable.

Euphorbia pentadactyla Griseb. in Abhandl. Gesell. Wiss. Goettingen **24**: 63. 1879.

PARAGUAY: Gran Chaco: Carandaity, *Rojas* 7287.

This species resembles *E. aureocincta* Croiz. but is easily recognized as distinct on account of its long filiform simple styles. The record seems to be new for Paraguay. Earlier records are all from Argentina.

Euphorbia Milii Des Moul. in Bull. Hist. Nat. Soc. Linn. Bordeaux **1**: 27. pl. 1. 1826; Desf. Cat. Hort. Paris. ed. 3. 475. 1829; Croiz. in Jour. Arnold Arb. **21**: 506. 1940.

Euphorbia splendens Boj. ex Hook. in Bot. Mag. **56**: pl. 2902. 1829; Denis, Euph. Iles Austr. Afr. 82. 1922.

PARAGUAY: Asunción, cultivated in the Botanical Gardens, *Rojas* 1264.

The reasons calling for the reinstatement of Des Moulins' neglected name have been given in my paper cited above.

Euphorbia Hinkleyorum I. M. Johnst. in Contr. Gray Herb. n. s. **70**: 72. 1924.

ARGENTINA: Jujuy: Tilcara, Cerro Peña Alta, *Venturi* 4916.

The classical locality is Mt. Chachani, near Arequipa, Peru. This is a new record for Argentina, and the species may be expected from Bolivia. The forms in this group bear an interesting relationship to *E. claytonioides* N. E. Br. of Angola in West Africa.

Euphorbia pampeana Speg. in Rev. Jard. Zool. Buenos-Aires **1**: 30. 1893.

URUGUAY: Canelones: Las Brujas, *Lombardo* 1959.

This is probably a new record for Uruguay. The polymorphism of this species under conditions of experimental cultivation is hardly credible; the leaves vary from obovate to narrow-linear and from manifestly pubescent to fully glabrous, as I have observed the species in cultivation.

Euphorbia phosphorea Mart. in Spix & Mart. Reise Brasil **2**: 612. 1828, *in nota*; Boiss. in DC. Prodr. **15**(2): 176. 1862; Muell.-Arg. in Mart. Fl. Bras. **11**(2): 692, pl. 95. 1874; Mansf. in Monatschr. Kakt.-Gesell. **3**: 244. 1931.

Euphorbia rhipsaloides Glaz. in Bull. Soc. Bot. France **59**(Mém. 3g): 638. 1912, nec alior. Syn. Nov.

BRAZIL: Bahia: Queimadas, *Rose & Russell* 19848 (in herb. N. Y. Bot. Gard.).

The peculiar phosphorescent sap of this plant, noted by Martius and by Glaziou, is often mentioned in the literature, but I have seen only the cited specimen which may belong here. The place of publication of the binomial is variously reported, but I am satisfied that the reference given above is correct, for the Latin description is given in the footnote cited; "p. 726," cited by Boissier, Index Kewensis, and most authors, merely contains Martius's comments on the phosphorescent properties of the latex. Mansfeld puts this species in the Sect. *Pteroneuræ* together with *E. Weberbaueri* Mansf., *E. Sipolisii* N. E. Br., and *E. pteroneura* Berger. My understanding, on the contrary, is that *E. phosphorea* has a distinct position of its own.

Euphorbia orizabae Boiss. in DC. Prodr. **15**(2): 147. 1862.

GUATEMALA: Quiché: Nebaj, 6400 ft., *Skutch* 1734; Chimaltenango: Cerro de Tecpám, alt. 2400-2700 m., *Standley* 61046; Quezaltenango: Ostuncalco, alt. 2700 m., *Standley* 66410.

The record is apparently new for Central America. The peculiar velutinous indumentum of the branchlets and floral parts immediately separates this species from the forms around *E. campestris* Cham. & Schlecht.

Chamaesyce S. Gray emend. Croizat

The difference in habit between *Chamaesyce* and *Euphorbia* in a narrow sense is said by Wheeler, in *Rhodora* **43**: 99. 1941, to have been caused by a process of reduction in the main axis, as follows, "When by progressive reduction of the main axis subg. *Chamaesyce* finally arrived at the habit of branching after the first pair of true leaves appeared, the plant was obviously too small to produce all the elaborate foods necessary for a

production of a cyathium with its reproductive structures requiring abundant protein, fats, and carbohydrates; so we find that the cyathium which would otherwise terminate the main axis is omitted."

This account does not require explicit refutation for the benefit of anybody acquainted with plant physiology. The ultimate destination of food is ruled in living organisms by highly complex metabolic equations, and no plant is ever so bereft of "abundant protein, fats, and carbohydrates" as to be incapable of yielding one flower, or cyathium, in lieu of one or several vegetative buds. The *Chamaesyce* which, according to the explanation just quoted, is so weak (let us notice: phylogenetically) as to deny itself the luxury of an apical reproductive structure, is vital enough to produce up to five or six buds set around the portion of the stem which ought to bear the apical cyathium but is said to be incapable of doing so. These buds, in their turn, may yield an internode which is immediately floriferous, so that several cyathia may be brought forth immediately above the point at which not a single one could arise on account of the lack of proteins, fats, and carbohydrates, if the explanation of Wheeler were to be accepted.

This is not all; *Chamaesyce* includes at least one-third of the species commonly treated as *Euphorbia* and is the most widespread of the Euphorbiaceae, with the exception, perhaps, of *Euphorbia* Sect. *Tithymalus* in the sense of Boissier. Its vitality is astounding, and its morphologic range exceedingly varied, including fugacious annuals barely a few inches long, and trees in which a true woody trunk appears formed by the ultimate fusion of the internodal growth peculiar to the group. There is not the slightest evidence to favor the belief that this group has been derived in evolution from some other aggregate already differentiated as *Euphorbia* in the modern sense; its range, morphology, and physiology point to its being one of the archetypes of the Euphorbiaceae, certainly not a moribund offshoot of some "Section" of the Linnaean genus. The interpetiolar stipules of *Chamaesyce* do not seem to be homologous with ordinary stipules but to have arisen in evolution by the reduction and specialization of a quaternate foliar verticil, this in itself being an indication that the theory of progressive reduction advanced by Wheeler neglects the fact that specialization and differential growth, rather than reduction, are involved in the shortening of the axes of *Chamaesyce*. It will be obvious that, treated as a section, a subgenus, or a genus, *Chamaesyce* is not to be interpreted as suggested by Wheeler; for its phylogeny, morphology, and life-history contradict this interpretation on the strength of factors which have nothing to do with the taxonomic and nomenclatural preferences of an author.

Chamaesyce may be treated in subordination under *Euphorbia* by any botanist who accepts traditional values as absolute, and it is not my intention to dispute the legitimacy of such a point of view so long as it is knowingly held. I accept *Chamaesyce* as a genus for the following reasons: (1) it includes not less than 600 species and manifestly stands for one of the largest aggregates in the Euphorbiaceae; (2) the difference is fully as

great between *Euphorbia* and *Chamaesyce* as it is between *Mallotus* and *Macaranga*, *Glochidion* and *Phyllanthus*, *Alchornea* and *Cleidion*, *Cnidocolus* and *Jatropha*, and the like (this vital fact is generally unknown to local students of *Euphorbia*); (3) the peculiarities of the stem-abortion of *Chamaesyce*, so far dismissed as "habit," are of far-reaching phylogenetic and morphological significance; (4) the species under *Chamaesyce* with few exceptions (probably not more than 10–15 species in the group called by Boissier *Euphorbia* sect. *Zygophyllidium*) are readily identifiable in the herbarium; (5) the characters of the nectaries on the cyathium, which are currently used to segregate from *Euphorbia* about 50 species of *Monadenium* and *Synadenium* and a single species of *Diplocyathium* (see Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **19c**: 43–44. 1931), could consistently be used to break up the Linnaean genus into many genera (*Dactylanthus*, for instance), thus reintroducing in its classification the confusion which Boissier sought to eliminate. To reject spurious "floral characters," full of unwelcome possibilities for classification, and to take up in their stead broad morphologic and phylogenetic concepts is sound and conservative taxonomy.

Chamaesyce chamaerrhodos (Boiss.) comb. nov.

Euphorbia chamaerrhodos Boiss. Cent. Euph. 2. 1860, in DC. Prodr. **15**(2): 51. 1862, Ic. Euph. 13. pl. 25. 1866.¹

PARAGUAY: Carapeguá, *Rojas* 3352.

The collection cited is excellent evidence of the dimorphism of this species, the crowded short floriferous axes being unlike the long and sterile shoots. The former strongly suggest the growth of **Chamaesyce potentilloides** (Boiss.) comb. nov. (*Euphorbia potentilloides* Boiss.), the latter that of *C. hirta* (L.) Millspaugh.

Chamaesyce Selloi (Boiss.) comb. nov.

Euphorbia Selloi Boiss. in DC. Prodr. **15**(2): 50. 1862, Ic. Euph. 13. pl. 22. 1866.

This is a collective species with numerous forms. The one described below differs from the type, illustrated by *Sello* 170, in the characters of the seed.

Chamaesyce Selloi var. **brevisemina** var. nov.

Semine ovoideo potius quam trigono-acuminato in faciebus inter costulas leviusculo potius quam impresso a formis typicis recedit.

ARGENTINA: Entre Ríos: Concordia, *Burkart* 822.

Chamaesyce Meyeniana (Kl.) comb. nov.

Euphorbia Meyeniana Kl. in Nova Acta Acad. Leop.-Carol. Nat. Cur. **19**: Suppl. 1: 414. 1843 (Meyen. Obs. Bot.); Boiss. in DC. Prodr. **15**(2): 42. 1862.

PARAGUAY: Chaco Paraguayo: Puerto Casado, *Rojas* 2171; Isla Poi, *Rojas* 7070.

The former specimen particularly is an excellent match for such Bolivian

¹See Briquet, in Bull. Soc. Bot. Suisse **50a**: 57, footn. 1. 1940, for the date of this work. Pritzel errs in both editions of the "Thesaurus," giving the date for the Icones as 1856. The "Centuria Euphorbiarum" is overlooked by Pritzel and by most bibliographers.

collections as *Pentland* (?) 109 and *D'Orbigny* 1207. This is a new record for Paraguay.

Chamaesyce Eichleri (Muell.-Arg.) comb. nov.

Euphorbia Eichleri Muell.-Arg. in Jour. Bot. **12**: 232. 1874.

PARAGUAY: C h a c o : Puerto Casado, *Rojas* 2170; Loma Porá, *Rojas* 2969.
ARGENTINA: T u c u m á n : Tapia, *Venturi* 2320; S a l t a : Orán, *Schreiter* 10991.

This appears to be a new record for Paraguay. The identifications were made on the basis of a photograph of *Lorentz* 301, in the Delessert herbarium, and the description.

Chamaesyce Lorentzii (Muell.-Arg.) comb. nov.

Euphorbia Lorentzii Muell.-Arg. in Jour. Bot. **12**: 231. 1874.

URUGUAY: locality ?, *Arechevaleta* 5192 a. ARGENTINA: B u e n o s A i r e s : Belgrano, *Parodi* 9879; Tigre, *Parodi* 11095, *Hicken* 441, *Burkart* 5711; Los Talas, *Marelli* 39; Belgrano Bajo, *Burkart* 3632; Delta Paraná, *Burkart* 8357.

The record for Uruguay is new, I believe. The determinations were based on a photograph of *Lorentz* 466, from the Berlin herbarium, and the description. This species tends to be restricted to very moist habitats.

Chamaesyce emarginata (Kl. & Garcke) comb. nov.

Anisophyllum emarginatum Kl. & Garcke in Abhandl. Akad. Berlin 24. 1860.

Euphorbia emarginata Boiss. in DC. Prodr. **15**(2): 32. 1862; Muell.-Arg. in Mart. Fl. Bras. **11**(2): 681. 1874.

URUGUAY: R í o N e g r o : Isla del Pedion, *Rosengutt B* 1472. ARGENTINA: E n t r e R í o s : Gualaguaychú, *Burkart* 4146.

The *Burkart* record requires confirmation, as the determination was effected from fragmentary material. The identifications were made from the descriptions and on the basis of a photograph of *Sellow*, the type specimen in the Berlin herbarium.

Chamaesyce hirtella (Boiss.) comb. nov.

Euphorbia hirtella Boiss. Cent. Euph. 7. 1860, in DC. Prodr. **15**(2): 24. 1862.

URUGUAY: C a n e l o n e s : Las Brujas, *Lombardo* 1958.

This is an exceedingly critical entity which probably connects two or three species that may be discussed later. The record is apparently new for Uruguay.

Chamaesyce Duckei sp. nov.

Perennis basi lignosa, caulibus stricte adscendentibus ultrapedalibus, innovationibus molliter albo-lanulosis citius glabratis. Foliis novellis membranaceis parcius albo-lanulosis vel glabratis, manifeste petiolatis, lamina ad 1.5 cm. longa, ca. 0.3 cm. lata, lanceolata vel elliptico-lanceolata vel anisophylla, margine subintegra, petiolo gracillimo ca. 2–3 mm. longo, stipulis linearibus vel triangularibus minutis. Cyathiis subsolitariis longe campanulatis ad 1–1.5 mm. longis, fauce ca. 1 mm. latis, nectariis ellipsoideis centro impressis, appendicibus petaloideis plus minusve profunde laciniato-sectis albicantibus, flore ♀ obpyriformi albicante tomentello vel lanuloso, capsula submatura glabrescente ovoideo-trigona ad 2 mm. longa et 1.5 mm. lata, stylis gracilibus ad 1.5 mm. longis ut videtur integris.

BRAZIL: P a r á : Furnas, on the Middle Tapajoz, *Ducke* 18534.

The characters of this plant are outstanding, and that it represents a new

species seems to be obvious. The material, however, is hardly satisfactory for a generalized description, because it shows a stage in which the new growth is barely beginning, but the old branchlets have already lost their leaves. It is altogether likely that the leaves and stipules of a free grown shoot will not be found to agree closely with those here described.

***Chamaesyce Barberiana* sp. nov.**

Herba annua vel potius perennans vix ultra pedalis suberecta multicaulis, caulibus in sicco stramineis vel pallide brunneis crispule albido-puberulis, internodiis ipsis maximis vix 3.5–4 cm. longis, stipulis interpetiolaribus in laciniis subintegris acutatis 3 vel 4 dissectis; foliis more generis basi anisophyllis, apice obtuse acuminatis vel rotundatis, membranaceis, 0.5–2 cm. longis, 0.5–1 cm. latis, ellipticis vel rotundato-ellipticis nequaquam linearibus vel rotundato-linearibus, glabris vel puberulis, margine cartilagineo sat obtuse distanterque serrato. Inflorescentiis apicalibus capituliformibus ca. 1–1.5 cm. longis fere totidem latis, confertis minutissime bracteolatis saepius dichotomis dein iterum 2- vel 3-partitis; cyathio hirtulo vel puberulo longiuscule campanulato raro subinflato ca. 1.5 mm. longo 1 mm. lato, nectariis diminutis appendice rotundata albicante circumdatis lobis minutissimis subtruncatis, floribus ♂ paucis; capsula evidenter longiore quam lata ca. 2 mm. longa, basi ca. 1.25 mm. lata, stylis vix 1 mm. longis, partitis, coccis crispule puberulis vel glabris dorso lineato-constrictis, columella gracili ca. 1.5 mm. longa, semine acutissime trigono rubello ca. 1–1.25 mm. longo, 0.4–0.6 mm. basi lato, faciebus transverse ruguloso-insculptis.

PARAGUAY: Chaco Paraguayo: Irendagué, *Rojas* 7213 (TYPE). ARGENTINA: Santiago del Estero: C. Pellegrini, *Venturi* 5663, 5956; Tucumán: Burruyaco, *Venturi* 7690; Entre Ríos: Paraná, *Burkart* 439; San Luis: Sierra del Gigante, *Pastore* 67; Córdoba: Casquin (?), *Rodrigo* 251.

This in the main is the entity which I have mistaken, in *Lilloa* 6: 299. 1941, for *C. indica* (Lam.) Croizat. My error is not entirely unaccountable, because the vegetative parts of these plants are practically identical. However, the seeds of the two species, which only recently I have had the opportunity of studying to my satisfaction, are altogether unlike. Seeds of *C. indica* are more or less ovoid and dark in color, while those of *C. Barberiana* are narrow, pointed, and reddish brown.

Chamaesyce Barberiana is a strong species which closely resembles no other of its range. In Boissier's monograph it would take its place immediately next to *C. Berteriana* (Balb.) Millsp. of the West Indies. The specific name honors Dr. Andrés Barbero, President of the Sociedad Científica del Paraguay, to whom so much is owed by all students of the natural history of that Republic.

***Chamaesyce portucasadiana* sp. nov.**

Planta certissime perennis e caudice lignoso ramos plures duros repentes brevissime albicanti-tomentellos vel rarius glabratos edens ad 30 cm. longos et ultra, stipulis setaceis triangularibus inconspicuis. Foliis saepius valide costatis ellipticis vel ovato-ellipticis, brevissime petiolulatis, 0.4–1 cm. longis, 0.2–0.7 cm. latis, plus minusve profundius serratis adpresse setulosis. Cyathis cupuliformibus in axillis singulis vel subsingulis, ca. 2 mm. longis

et latis, puberulis, nectariis late albo-appendiculatis, ovario rotundato-trigono albicante tomentello vix 1.5 mm. longo latoque, stylis brevibus apice bilobis.

PARAGUAY: Chaco Paraguayo: Puerto Casado, *Rojas* 2152.

This plant was originally identified as representing *Euphorbia thymifolia* L., a determination probably influenced by Chodat & Hassler's earlier acceptance of this species for the region. A full discussion of *E. thymifolia* is here impossible, but on the basis of *Metz* 67, an Asiatic specimen which Boissier cites under that binomial, in DC. Prodr. **15**(2): 47. 1862, it is obvious that *C. portucasadiana* has characters wholly incompatible with those of Linnaeus' species as represented by the Metz collection. The description of *E. argillicola* Chod. & Hassl., if at all correct, cannot apply here.

***Chamaesyce oranensis* sp. nov.**

Perennans lignescens, rosulata vel repens suberecta, tota hispidulo-velutinosa pallide olivacea vel grisea, internodiis pro more nec ultra 0.5 cm. longis, maximis 1–2 cm. longis. Foliis rotundato-ellipticis, 0.5–1 cm. longis, 1–6 mm. latis, velutino-puberulis, margine sat grosse serratis, subsessilibus, stipulis setaceis minutis deciduis. Cyathiis in axillis pluribus aggregatis campanulatis valde tomentellis ca. 1.5 mm. longis, nectariis rotundatis minimis appendice petaloidea subnulla, flore ♀ canescente stylis brevissimis glabris partitis; capsula ovato-trigona ca. 1.25 mm. longa 1 mm. basi plus minusve lata, semine ellipsoideo griseo-rubello transverse ruguloso ca. 1–1.25 mm. longo et 0.75 mm. lato.

ARGENTINA: Salta: Orán, *Venturi* 5555 (TYPE). PARAGUAY: Chaco Paraguayo: Chamachini, *Rojas* 7224.

The floral characters of this new species are not outstanding, but the habit is distinctive and is immediately recognizable. The internodes are usually only 0.5 cm. long, and the stems become manifestly woody with age.

***Chamaesyce catamarcensis* sp. nov.**

Humilis glaberrima, caules verosimiliter annuos e radice perenni edens. Foliis crassiusculis integerrimis linearibus, apice obtuse rotundato-apiculatis, 7–14 mm. longis, 1–1.5 mm. latis, petiolo vix 1–2 mm. longo, stipulis interpetiolaribus fimbriatis minutis. Cyathiis in axillis singulis ob internodiorum breviter in pseudocymulis apicalibus congestis vix 1 mm. longis, nectariis 4 vel 5 exappendiculatis vel parcellis appendiculatis in involucrium longe decurrentibus, staminibus paucis; flore ♀ elongato trigono glaberrimo, stylis 3 brevissimis partitis; capsula matura ca. 2 mm. longa et 1.25 mm. lata, gynophoro 1.5–2 mm. longo, semine quadrangulo apice valde acuminato basi truncato, in lateribus rugis profundis horizontalibus ad 6–10 ornato, arillo albicante, testa rubrobrunnea.

ARGENTINA: Catamarca: Andalgá, *Jørgensen* 1621.

This resembles *C. caecorum* but has blunter leaves and a different seed.

***Chamaesyce caecorum* (Boiss.) comb. nov.**

Euphorbia caecorum Mart. ex Boiss. in DC. Prodr. **15**(2): 51. 1862; Muell.-Arg. in Mart. Fl. Bras. **11**(2): 675. *pl.* 92. 1874; Boiss. Ic. Euph. 13. *pl.* 23. 1866; Chod. & Hassl. in Bull. Herb. Boiss. II. **5**: 681. 1905.

The spelling *caecorum* is to be retained as the one used by Boissier in the original publication. Mueller's reference to the place of publication is garbled, confusing as it does the unpublished "Pl. Med. Bras. t. 73 ined.," cited by Boissier, and the "Icones Euphorbiarum."

This species is frequent in Brazil and probably not rare in Paraguay, witness: *Rojas* 6339, Sierra de Amambay. I have so far not seen it from Argentina. The ternate and quaternate verticils, illustrated by Mueller and Boissier, on the lower nodes suggest a theoretical primitive condition, antedating the transformation of two leaves of the verticil into interpetiolar stipules.

Chamaesyce hirta (L.) Millsp. in Field Mus. Publ. Bot. **2**: 303. 1909.

Euphorbia hirta L. Sp. Pl. 454. 1753; Boiss. in DC. Prodr. **15**(2): 21. 1862 (as *E. pilulifera*); Wheel. in Contr. Gray Herb. **127**: 67. 1939, in *Rhodora* **43**: 169. 1941.

This widespread weed has been confused both in herbaria and in the literature with *C. pilulifera* (L.) Small. This confusion arose through accepting a concept of *E. pilulifera* L. based on the plant described in the *Amoenitates Academicæ* **3**: 114. 1756, rather than on that of the *Species Plantarum* (1753), which has priority. As Boissier points out (op. cit. 20), the plant originally determined as *E. pilulifera* in the Linnaean herbarium actually represents *E. parviflora* L., which was not published until 1759. To *E. pilulifera* L. and the combinations based upon it, *E. parviflora* L. must be added as a synonym.

Chamaesyce hirta L. subsp. **procumbens** (Boiss.) Croiz. in *Lilloa* **6**: 299. 1941.

Chamaesyce hirta L. var. *procumbens* (Boiss.) Mold. in *Rev. Sudam. Bot.* **6**: 178. 1940.

ARGENTINA: Buenos Aires: Villa Ortuzar, *Parodi* 12819; Tucumán: Villa Luján, *Venturi* 167, Trancas, *Venturi* 4386, Tapia, *Rodriguez* 526; Salta: Orán, *Rodriguez* 96, Candelaria, *Venturi* 3659; Córdoba: Unquillo, *Bruch* 5005. CULTIVATED: *Croizat* s. n.

This characteristic form is weaker and smaller than the typical plant and has a fairly thickly arillate seed, the testa of which is dusty-grayish rather than brick-colored. It is particularly abundant in Argentina, the collections cited being representative. In some of its most diffuse states (for instance, *Rodriguez* 526, *Bruch* 5005, and *Croizat* s.n.) this entity is close to **Chamaesyce microcephala** (Boiss.) comb. nov. (*Euphorbia microcephala* Boiss. in DC. Prodr. **15**(2): 1262. 1866), which in its turn does not seem to differ enough from the form called by Wheeler *E. hirta* var. *destituta*, in Contr. Gray Herb. **127**: 70. pl. 4, C 1. 1929).

Chamaesyce hirta var. **laeticincta** var. nov.

Nectariis saepius appendicibus petaloideis albicantibus sat magnis insignitis, foliis saepius sub apicem rhombeo-dilatatis.

PARAGUAY: Chaco Paraguayo: Puerto Casado, *Rojas* 2819.

I have not seen material representing *Euphorbia Karwinskyi* Boiss., which, according to Wheeler, in Contr. Gray Herb. **127**: 71. 1939, should not be far remote from *E. hirta* var. *nocens* Wheel. and somewhat suggests this new variety in the descriptions. In its most characteristic state this

variety is easily recognizable by the white petaloid appendages of the nectaries on the cyathium.

Chamaesyce serpens (H. B. K.) Small, Fl. Southeast. U. S. 709, 1333. 1903.

Euphorbia serpens H. B. K. Nov. Gen. & Sp. 2: 41 [*folio*], 52 [*quarto*]. 1817; Boiss. in DC. Prodr. 15(2): 29. 1862; Wheel. in Contr. Gray Herb. 136: 198. 1941.

PARAGUAY: C h a c o P a r a g u a y o : Lopez de Filippis, *Rojas* 8278; Puerto Casado, *Rojas* 2161.

The first of these specimens is an absolute match of the typical plant collected at Cumaná. In this plant the stipules definitely tend to be triangular-truncate, not laciniate-partite. *Rojas* 2161 is a microphyllous state and evidently a perennial from a comparatively thick rootstock. This suggests that the species is annual only where conditions are unfavorable.

Chamaesyce serpens var. **montevidensis** (Boiss.) comb. nov.

Euphorbia ovalifolia montevidensis Boiss. in DC. Prodr. 15(2): 43. 1862.

Euphorbia serpens var. *fissistipula* Thell. in Bull. Herb. Boiss. II. 7: 755. 1907. Syn. Nov.

URUGUAY: Montevideo, *Casaretto* 453 (type number); *Arechevaleta* 5204, *Lombardo* 222, *Legrand* 394. ARGENTINA: B u e n o s A i r e s : Mar de la Plata, *Hicken* 642; Lobería, *Scala* (*Alboff*) s. n.

It is possible that *C. serpens* and *C. ovalifolia* cannot be distinguished with finality as separate species, but it seems clear that the var. *montevidensis* rather agrees with the former than with the latter on account of the habit and foliage and the less evolute petaloid appendages.

Lombardo 222 bears the local name "Yerba Meona." This same name is given by Larrañaga, Escr. D. A. Larrañaga, Inst. Geogr. Uruguay 2: 165. 1923, to his *E. diuretica*, which is described altogether too briefly but is said to be "pubescens." Clearly, *E. diuretica* is not *E. serpens* or any of its forms, for these are glabrous. The binomials of Larrañaga are published with descriptions so sketchy that, in this group, it proves impossible to place them without access to authentic material for study and comparison.

EXCLUDED FROM THE EUPHORBIACEAE

Ayenia pusilla L. Syst. ed. 10. 1247. 1759.

Tragia Mansfeldiana Hert. in Rev. Sudam. Bot. 3: 166. 1936, *nomen*; op. cit. 5:34. fig. 6. 1937. Syn. Nov.

I am indebted to Señor A. Lombardo for data, drawings and notes which provide definite proof that Herter's species is not euphorbiaceous but is a well-known sterculiaceous plant, *Ayenia pusilla* L. The reduction here made is based on *Chebataroff* 6352 in our herbarium, bearing the original sketches and comments of Señor Lombardo.

ARNOLD ARBORETUM,

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THE FAMILY HIMANTANDRACEAE

I. W. BAILEY, CHARLOTTE G. NAST, AND A. C. SMITH

With six plates

THE present paper is the second of a proposed series discussing the inter-relationships of the families of woody Ranales. We have already briefly discussed the position of the Himantandraceae as a relative of the Magnoliaceae and the Degeneriaceae (1). These three families form a compact group within the Ranales, being more closely related to each other, on the basis of important morphological details, than any one of them is to other families.

The most important contributions to our knowledge of the Himantandraceae were made by Diels (3, 4, 5), with whose conclusions (5: 134) that the closest relative of the group is the Magnoliaceae we are in essential agreement. Diels has discussed *Himantandra* in considerable detail, and therefore we shall emphasize those points which he was unable fully to observe, and especially those characteristics of *Himantandra* which we interpret differently.

The first part of this paper presents a diagnosis of the technical characters of *Himantandra*, the sole genus of the family, and the two known species. Only the essential citations to literature are given, as fuller citations were recently listed (7) and the status of the generic name was discussed. In the second part of this paper we shall examine the internal morphological features of the genus, with special reference to points not made entirely clear by Diels. Specimens cited in this treatment are deposited in the herbarium of the Arnold Arboretum. The morphological and anatomical portions of this study have been prepared by the first two authors, the taxonomic portion by the third author, while the conclusions are the result of collaborative discussions.

I

Himantandra F. v. Muell. Pap. Pl. **2**: 54. 1890.

Galbulimima F. M. Bailey in Queensl. Dept. Agr. Bot. Bull. **9**: 5. 1894.

Trees, the branchlets slender, subterete or faintly angled distally, densely lepidote; scales covering the young branchlets, petioles, lower surface of leaf-blades, and external parts of inflorescence (except stamens and staminodes), these scales peltate, membranaceous, castaneous, dark at center, paler toward margin, the stalk very minute, the body composed of 30–56 radiating flattened laterally coalescent hairs; stipules none; leaves alternate, simple, pinnate-nerved; petioles slender, rugulose; leaf-blades coriaceous or thin-coriaceous, entire and faintly recurved or plane at margin, the costa prominent beneath, the secondary nerves 7–16 per side (interspersed

with other similar but weaker or obscure laterals), spreading, anastomosing toward margin (either freely or obscurely so); flowering shoots axillary, customarily with 1 terminal flower, with 2 (sometimes 3) alternating bracts, the bracts subcoriaceous, oblong, 1-3 mm. long, occasionally foliaceous, with obscure axillary buds, these buds rarely developing into subsidiary flowering axes with two scales and an apical flower; pedicel similar to the flowering shoot in texture; calyx subcoriaceous, ovoid-conical, obtuse or umbonate at apex, calyptrate, rupturing along an irregular line near base and leaving a small undulate or irregularly lobed calycine remnant attached to the torus, glabrous within, densely and uniformly lepidote without; corolla similar to calyx in texture, shape, and indument, slightly smaller than and closely enveloped by the calyx, similarly calyptrate; torus carnos, flaring to the attachment of the calyx and corolla, thence columnar and copiously stamiferous, concave on the distal surface and giving rise to a conical carpel-bearing apex; outer staminodes about 7-23, 1- or 2-seriate, castaneous, carnos, sharply reflexed after anthesis; stamens numerous, several-seriate, closely appressed, similar to outer staminodes in texture and shape, rapidly elongating and reflexed after dehiscence of the perianth, the pollen-sacs 4, paired, extrorse, immersed in the sporophyll-tissue, linear, obtuse at base and apex, dehiscing longitudinally; inner staminodes about 13-20, 1-3-seriate, similar in texture to the outer staminodes, linear-subulate, gradually narrowed to an acute apex, usually erect and more or less coherent at base; carpels spirally arranged on the conical apical portion of the torus, free but laterally appressed and soon concrescent, the ovary ovoid or oblong-ellipsoid, densely lepidote on the thick outer surface, glabrous on the thinner lateral surfaces, gradually narrowed distally into a subulate style, the styles plume-like, soft and glandular in texture, sometimes cohering in a gelatinous mass, the locule 1, the ovule 1 (rarely 2, but the second seldom developing), anatropous, attached to the ventral margin at various levels in different carpels; fruit an ellipsoid or subglobose syncarp, up to 25 mm. in diameter at maturity, rounded or obtuse at base and apex, the pericarp coriaceous, 0.5-1.5 mm. thick, red, rugulose when dried, lepidote without, the scales long persistent, the carpels completely coalesced, often imbricate and superposed in 2 or 3 ranks, the exterior ones appearing shorter than the interior, the dissepiments coriaceous, persistent, the endocarp cartilaginous, the seeds solitary (or possibly rarely 2), with oily endosperm and small embryo near the hilum.

KEY TO THE SPECIES

- Leaf-blades usually oblong-elliptic, (6-)7-15 cm. long, (3-)4-7 cm. broad (2-2.5 times as long as broad), obtuse to acute at base, rounded to acute at apex; scales on lower surface of mature leaf-blades 0.15-0.4 mm. in diameter, crowded, usually completely obscuring the surface, the margins of adjacent scales often imbricate, at least contiguous, only rarely not touching; outer staminodes about 12-23; stamens 90-130, 6-25 mm. long; inner staminodes 15-20; carpels 9-15; New Guinea (and probably North Moluccas). 1. *H. Belgraveana*.
- Leaf-blades oblong-lanceolate, 7-11.5 cm. long, 2-4 cm. broad (about 3 times longer than broad), acute to attenuate at base, subacute to short-acuminate at apex; scales on lower surface of mature leaf-blades 0.13-0.17 mm. in diameter, comparatively scattered, the margins of adjacent scales not imbricate, rarely contiguous; outer staminodes about 7; stamens about 40, 6-9 mm. long; inner staminodes about 13; carpels 7-10; Queensland. 2. *H. baccata*.

1. **Himantandra Belgraveana** (F. v. Muell.) F. v. Muell. Pap. Pl. **2**: 54. 1890.

Eupomatia Belgraveana F. v. Muell. in Austral. Jour. Pharm. **2**: 4. 1887, in Bot. Centralbl. **30**: 325. 1887.

Galbulimima Belgraveana Sprague in Jour. Bot. **60**: 138. 1922.

Himantandra nitida Bak. f. & Norman in Jour. Bot. **61**: Suppl. 2. 1923.

Galbulimima nitida Sprague in Jour. Bot. **61**: 200. 1923.

Tall tree, up to 25 m. or more high; branchlets straight or subflexuose, 2-4 mm. in diameter toward apices, pale brown or castaneous or at length fusco-cinereous; scales 0.15-0.4 mm. in diameter, crowded, usually completely obscuring the surface, the margins of adjacent scales often imbricate; petioles 1-2 mm. in diameter, 8-24 mm. long, deeply or shallowly canaliculate; leaf-blades coriaceous, brown or dark olivaceous, smooth or densely and minutely papillose, and shining or dull above when dried, castaneous- or fuscous-lepidote beneath, oblong (rarely ovate- or obovate-) elliptic, (6-)7-15 cm. long, (3-)4-7 cm. broad, obtuse to acute at base, rounded to acute and sometimes inconspicuously mucronulate at apex, the costa impressed or deeply canaliculate above, the secondary nerves 8-16 per side, straight, sharply raised or prominulous or immersed above, faintly prominulous or immersed beneath, the veinlets immersed, occasionally forming a faintly prominulous reticulum above and rarely beneath; flowering shoots 1.5-6 cm. long inclusive of flower or fruit, the vegetative portion slender, rugulose, 1-2 mm. in diameter, up to 25 mm. long, the pedicel gradually swollen distally to 3 mm. in diameter, 8-16 mm. long at anthesis, up to 20 mm. long in fruit; calyx 9-16 mm. long and 8-13 mm. in diameter at anthesis; outer staminodes about 12-23, 1- or 2-seriate, oblong-ligulate, 5-11 mm. long at anthesis and probably often longer, 1.5-2 mm. broad near base, gradually narrowed to a sharp and often unequally apiculate or rostrate apex, sometimes sparsely pellucid-glandular; stamens 90-130, usually 6- or 7-seriate, 6-25 mm. long, 1.5-2 mm. broad near base, often with numerous and obvious sclereids and obscurely or obviously striate, the pollen-sacs 0.8-1.8 mm. long, the lower edge 0.6-3 mm. distant from the base of the sporophyll; inner staminodes 15-20, 1-3-seriate, 5-7 mm. long, 0.5-1.3 mm. broad near base; carpels 9-15, 4-6 mm. long at anthesis, the ovary 1.5-2 mm. long; fruit with seeds (in all our specimens) solitary, flattened, submembranaceous, suborbicular, 3-4 mm. in diameter, apparently sterile.

DISTRIBUTION: New Guinea, and probably also some of the islands to the west. Diels (5: 131) reports that Warburg (no. 17770) collected loose flowers which are probably referable to the species at Sibela, on Batjan, an island south of Halmahera; extension of typical New Guinean elements to this region is frequent.

NETHERLANDS NEW GUINEA: Biak I., Seroei, alt. about 50 m., *Neth. Ind. For. Serv.* 30722, 30898; Japen I., Seroei, alt. about 370 m., *Neth. Ind. For. Serv.* 30406; 6-15 km. southwest of Bernhard Camp, Idenburg River, alt. 1300-1800 m., *Brass & Versteegh* 11195 (tree 25 m. high, frequent in primary forest on slopes of a ridge, the trunk 34 cm. diam., the crown not wide-spreading; bark 5 mm. thick, dark brown, fairly smooth; wood white; fruits red), *Brass & Versteegh* 12103 (tree to 25 m. high, abundant in mossy-forest; flowers white; fruits orange-brown), *Brass & Versteegh* 12572 (tree 21 m. high, occasional in primary forest on slopes of a ridge, the trunk 51 cm. diam., the crown fairly small; bark 9 mm. thick, gray, smooth; wood light brown; flowers yellow; fruits green). **NORTHEASTERN NEW GUINEA:** Sepik River region, Hauptlager Malu, alt. 50-100 m., *Ledermann* 10884a (frag.); Morobe District: Yunzaing, alt. 1200-1350 m., *Clemens* 3586, 3678, 6498, 6503 (large trees, the trunk to 1 m. diam.; fruit red); Ogeramngang, alt. 1750-1800 m., *Clemens* 4991, 5538; between

Ogeram nang and Tobou, alt. 1500–1800 m., *Clemens 6584a*; Matap, alt. 1500–1800 m., *Clemens 11100, 41200* (tall trees; "inflorescence" brown; flowers russet-green). BRITISH NEW GUINEA: Central Division, Mt. Tafa, alt. 2400 m., *Brass 4916* (tall tree, plentiful in valley forests, with slender trunk and thinly foliated crown; staminodes and stamens cream-colored; fruit brown).

In studying the above-cited specimens, we have noted certain differences which we have tried to correlate with the different geographic areas, thinking that more than one nomenclatural division of the genus might be discernible in New Guinea. However, our attempts to divide the New Guinean population have not succeeded, and we have reached the conclusion that only one species is represented.

The material from the Morobe District has the upper surface of the leaves usually dull and conspicuously rugulose-papillose, while the remaining collections have this surface comparatively shining and essentially smooth. However, there are exceptions to this generalization, and the texture of the upper surface appears to be subject to individual variation, possibly being dependent upon the size and distribution of stone-cells. The degree to which the secondary nerves are immersed is also subject to great individual variation, although in general the Morobe collections have more completely immersed nerves. When young, the leaves are infolded with the two halves of the upper surface closely appressed. Although mature leaves are always strictly glabrous on the upper surface, these young folded leaves sometimes bear small many-branched stellate hairs before they open. Such hairs are often found in material from the Morobe District, but they are apparently always lacking in the other specimens cited.

On the basis of size and number of floral parts, no important differences are found among the available collections, the species being very variable in this respect. The greatest variability is found in the size of the stamens and outer staminodes, which elongate rapidly after the dehiscence of the corolla. The longest stamens we have observed are 18 mm. long, but Diels (4) portrays the stamens of the type collection as about 25 mm. long, and we have no reason to doubt the accuracy of this observation.

From our study of the available material and the earlier descriptions, therefore, we are inclined to believe that *Himantandra* is represented in New Guinea by only one species.

Himantandra Belgraveana has as its type a specimen collected by Forbes (no. 759 according to Mueller, no. 795 according to Diels [4] and Baker [2]), collected in the vicinity of Sogere, British New Guinea. The original description does not give dimensions, but Diels' description in 1912 (4) is adequate. *Himantandra nitida* is based upon *Forbes 828a* from the same region; according to Baker and Norman this differs from the earlier species "by the shining broader coriaceous leaves and much longer stamens." A comparison of the description of *H. nitida* with our concept of *H. Belgraveana* does not demonstrate differences of any consequence.

2. *Himantandra baccata* (F. M. Bailey) Diels in Bot. Jahrb. **55**: 128. 1917.

Galbulimima baccata F. M. Bailey in Queensl. Dept. Agr. Bot. Bull. **9**: 5. 1894.

Tree up to 17 m. high, the branchlets 1.5–3 mm. in diameter toward

apices, brownish; scales 0.13–0.17 mm. in diameter, comparatively scattered, the margins of adjacent scales not imbricate, rarely contiguous; petioles 0.7–1 mm. in diameter, 8–20 mm. long, shallowly canaliculate; leaf-blades thin-coriaceous, dark brown and shining above when dried, castaneous-lepidote beneath, oblong-lanceolate, 7–11.5 cm. long, 2–4 cm. broad, acute to attenuate at base, subacute to short-acuminate at apex, the costa shallowly impressed or slightly raised above, the secondary nerves 7–10 per side, prominulous above, less conspicuously so beneath, the veinlets immersed or faintly prominulous above; flowering shoots up to 2 cm. long at anthesis, the vegetative portion angled, 5–13 mm. long, the pedicel shorter; calyx up to 10 mm. long and slightly less in diameter at anthesis; outer staminodes about 7, 1-seriate, lanceolate, 4–6 mm. long or probably longer after anthesis, acute; stamens about 40, several-seriate, 6–9 mm. long, the pollen-sacs 1.5–2 mm. long; inner staminodes about 13, 6–8 mm. long, narrowed at base; carpels 7–10, about 2 mm. long at anthesis; fruit with seeds "with a loose outer ragged coat; testa smooth, cartilaginous; albumen copious, oily. Embryo not particularly small near the hilum, apical with reference to the position of the seed in the berry." (ex F. M. Bailey).

DISTRIBUTION: Queensland, Australia.

AUSTRALIA: Queensland: North Queensland, Gadgarra, Peeramon, Atherton, *White 1561*. In addition to the preceding specimen, which is the only one we have seen, the following are cited by other writers, all from Queensland: Eumundi, *Arundell* (TYPE); Boar Pocket and Evelyn, Heberton District, *J. F. Bailey*; Kin Kin, North Coast Line, *Francis*.

Our description is based primarily upon the White collection, which is in fruit; we have also incorporated the characters and dimensions recorded by F. M. Bailey and Sprague (see Smith [7] for citations).

INADEQUATELY KNOWN SPECIES

HIMANTANDRA PARVIFOLIA Bak. f. & Norman in Jour. Bot. **61**: Suppl. 2. 1923.

Galbulimima parvifolia Sprague in Jour. Bot. **61**: 200. 1923.

This species, known to us only from the original description, is based on *Forbes 355*, from Meroka, British New Guinea. The leaves described seem closer to those of *H. baccata* than to those of *H. Belgraveana*, but they are even smaller than any described for *H. baccata*, being similar in proportions. The species is said to differ from *H. baccata* in its smaller leaves and flowers, but the dimensions given for the flowers do not indicate this to be the case. No numbers of floral parts are given.

From the locality, one would expect this to be a depauperate form of *H. Belgraveana*, but the leaf-proportions do not suggest this. If it represents *H. baccata*, the occurrence of this species in New Guinea will be noteworthy. *Himantandra parvifolia* may quite possibly be a good third species of the genus, but for the time being we are inclined to believe it an extreme variation of *H. Belgraveana*, which, as illustrated by the specimens cited above, seems best interpreted as a very variable species.

II

As indicated above, we are much better acquainted with the New

Guinean species than with the Australian, and consequently the following notes are based primarily upon *H. Belgraveana*, of which we have ample recently collected material. The Australian species and *H. Belgraveana* are very closely related and show only minor differences, and for this reason we do not doubt that remarks on the morphology of one species apply equally well to the other.

STEM. In *Himantandra baccata* and *H. Belgraveana*, as in *Degeneria* and the Magnoliaceae,¹ the primary vascular cylinder is a dictyostele, being constituted of discrete bundles that are separated by relatively wide gaps. Each bundle is capped externally by slender thick-walled fibers and is subtended internally by vertically elongated, thin-walled parenchyma. During the earlier stages of the formation of the secondary body, the external arcs of fibers tend to become united into a continuous ring of sclerenchyma by the sclerification of the intervening arcs of parenchyma. The bulk of the pith is composed of large comparatively thin-walled cells, but nests and transversely oriented plates of sclereids are of common occurrence, particularly in the nodal parts of the stem. The cortex is characterized by having numerous spherical secretory cells and more or less abundant sclereids. Crystalliferous parenchyma occurs in the cortex, phloem, and pith, usually in close association with the sclerenchyma. Each small crystal-bearing cell or chamber contains a single rhombohedral crystal of calcium oxalate that is jacketed by a thick sheath of lignified cellulose. As noted by Diels (5), the origin of the cork is superficial, probably hypodermal.

The rays of the first-formed secondary xylem are narrow, with a high ratio of uniseriate to biseriate, and are markedly heterogeneous. On the contrary, in wood from large stems (*fig. 10*), there is a high ratio of fusiform, nearly homogeneous triseriate and tetraseriate rays, and uniseriate rays are much reduced in size and number. The vessels of the first-formed secondary xylem are smaller, more numerous, and occur in more extensive radial seriations than they do in the later-formed wood (*fig. 9*). Furthermore, the vessels of the metaxylem and of the first-formed secondary xylem commonly exhibit a higher ratio of scalariform to porous perforations and of scalariform and opposite to alternate lateral pitting than do the vessels of the later-formed wood, where scalariform perforations and transitional types of lateral pitting are evanescent or vestigial. It should be noted in this connection that the discrepancies in Diels' (5) and McLaughlin's (6) descriptions of the wood of *Himantandra* may have been due in part to differences in the type of material examined by them. The wood fibers of *Himantandra* are comparatively thin-walled fiber tracheids, having small circular bordered pits. The wood parenchyma is of a broad banded apotracheal type (*fig. 9*). More or less numerous strands of crystal-bearing cells occur in association with the wood parenchyma.

¹Whenever mentioned in the following pages, the family Magnoliaceae is intended in the restricted sense of Dandy, Hutchinson, and others, viz. exclusive of the Winteraceae, *Illicium*, Schizandraceae, and *Tetracentron*.

In herbarium specimens of *Himantandra*, there is less conspicuous flaring of the rays in the secondary phloem than in comparable material of *Degeneria* and of most Magnoliaceae, and stratified hard and soft bast are less precociously developed. It is significant, however, that in larger stems the phloem is distinctly stratified and has flaring rays. Furthermore, the sieve tubes are of the same structural type as in the Magnoliaceae and *Degeneria*. Crystalliferous parenchyma occurs along the surfaces of the hard bast.

LEAF AND NODAL ANATOMY. In *Himantandra Belgraveana* and *H. baccata*, three traces enter the base of the petiole, leaving three gaps in the cauline vascular cylinder, i. e. the stems have typically *trilacunar* nodes. The three traces divide forming 6–8 vascular bundles that become oriented into a more or less cylindrical foliar dictyostele (fig. 8). As in *Degeneria* and the Magnoliaceae, the vascular strands that branch outward from the median trace are segregated in opposite sides of the foliar dictyostele. In other words, one or more of them retain a normal orientation of xylem and phloem and form part of the abaxial surface of the foliar stele, whereas the remaining ones develop an inverted orientation of xylem and phloem and form part of the adaxial surface of the foliar vascular cylinder. Thus, the vascularization of the petiole and midrib is of a fundamentally different type than that which occurs in such ranalian plants as *Tetracentron*, where a medullated foliar dictyostele is formed by the closure of an adaxially expanding arc of vascular tissue.

The young leaves of *Himantandra* are adaxially folded, i. e. conduplicate (fig. 3). They do not unfold until they have attained a considerable size, not infrequently a length of 8 centimeters or more in the case of the larger-leaved specimens. The exposed abaxial surfaces of the conduplicate leaves, from very early stages of their development, are provided with a dense coating of peltate scales (fig. 3). These scales are persistent on the unfolded mature leaves (fig. 1), but are smaller and less crowded in *H. baccata* than in *H. Belgraveana*. The adaxial or upper surfaces of mature leaves of all investigated specimens of *Himantandra* are glabrous, but the immature leaves of certain collections of *H. Belgraveana*, viz. *Clemens* 3586, 3678, 4991, 5538, 6498, 6503, and 6584a, bears scales or stellate hairs on their ventral surface during certain stages of their conduplicate development. The ray cells of these scales or stellate hairs are not firmly coherent and drop off during subsequent development of the leaf. However, the basal cells or stalks are persistent and are more or less widely scattered among the epidermal cells of the upper surface of the mature leaf.

The stomata of both *H. baccata* and *H. Belgraveana* have a very peculiar and highly characteristic distribution. As shown in fig. 2, they occur in discrete, nearly circular clusters that subtend each of the peltate scales on the lower surface of the leaf. Crystal-bearing cells, of the same morphological type as in the stem, are more or less abundant in the leaf. They tend to occur characteristically in pairs or small clusters in the lower epidermis (fig. 1), and in strands along the sclerenchymatous sheaths of the

veins and veinlets. Numerous clusters or nests of sclereids are scattered throughout the mesophyll of all the Clemens collections of *H. Belgraveana*, but they are absent or of less frequent occurrence in other material examined by us. Spherical secretory cells are abundantly developed in the leaf, as in the other organs of the plant.

FLOWERING SHOOTS. The solitary bisexual flowers of *Himantandra*, as of *Degeneria* and certain genera of the Magnoliaceae, e. g. *Michelia* and *Elmerrillia*, are borne at the apex of axillary shoots. These flowering axillary shoots are provided with two (occasionally three) scales which have more or less rudimentary buds in their axils. Since the scales frequently develop into typical leaves, they may be interpreted as reduced foliar organs. In exceptional instances, one of the buds develops a subsidiary flowering axis bearing two scales and an apical flower. The flowers are separated from the upper scale or leaf by an internode of considerable length, which may be designated as the pedicel in contrast to the essentially vegetative nodes and internodes that subtend it. The pedicel flares toward the base of the torus, forming a circular flange (figs. 11, 12), to which the calyptrate calyx is attached. A second internal flange provides an attachment for the calyptrate corolla. The carpel-bearing, cone-like apex of the torus (fig. 12) projects from the concave upper surface of the broadly columnar part of the receptacle, to which the stamens and staminodes are attached.

The axillary flowering shoot contains a dictyostele of many small bundles (figs. 15-18) similar to that of a typical vegetative branch, except for a short distance in the basal part of the pedicel. Here the bundles are constricted into four large vascular strands (fig. 17). Three traces (figs. 15, 16) enter¹ the first bract, leaving three gaps in the stele, just as in the case of the leaves of ordinary vegetative shoots. The three traces of the second bract (or leaf) initiate their departure at a slightly higher level and from the opposite half of the stele. Although these traces fluctuate considerably in their subsequent behavior, two of them (commonly the median and one lateral) tend to divide, forming two additional traces that extend upward through the cortex of the pedicel (figs. 15-18). A third set of three traces departs from the stele just above the level of the first node (fig. 16). These traces are detached from the same half of the stele as the three traces of the first scale and extend upward through the cortex of the second internode, the second node, and the pedicel (figs. 16-18). Thus, there are five cortical bundles in the base of the pedicel, to which is soon added a sixth bundle which departs from the same side of the stele as the median trace of the second scale (figs. 16, 17). As will be shown subsequently, these six cortical bundles of the pedicel vascularize the outer calyptra.

Since the foliar appendages of *Himantandra* have a $\frac{1}{2}$ phyllotaxy and are attached to trilacunar nodes, it is evident that the flowering shoot and

¹The terminology used is purely descriptive and bears no ontogenetic implications regarding downward or upward development of procambium, phloem, and xylem.

pedicel have four distinct sets of three traces, each set attached alternately to opposite sides of the stele. The lateral traces of the fourth set exhibit more or less conspicuous fusion to the traces of the second set. Therefore, the outer calyptra of the flower represents a pair of fused appendages, either bracts or sepals. It should be emphasized in this connection, however, that if the homologous appendages of *Degeneria* are typical sepals, the outer calyptra of *Himantandra* should similarly be designated as calyx. Furthermore, the calyptrate calyx of *Drimys* is obviously composed of two fused sepals.

The vascularization of the torus is extremely complex and variable. There is a network of variously oriented bundles which divide, anastomose, redivide, reanastomose, and shift position throughout the torus. The number and arrangement of the bundles varies to a certain extent in different flowers, indicating a lack of stabilization within the genus. A basic or average condition is, therefore, illustrated in *figs. 18-23*. The six cortical bundles of the pedicel (*fig. 18*) either bifurcate or break up into several branches (*fig. 19*). These branches divide laterally into smaller strands (*fig. 20*) and internally into strands which extend upward through the base of the torus (*fig. 21*). The lateral strands may divide or anastomose in the base of the outer calyptra, but eventually they enter its free part as numerous small strands variable in size and number (*fig. 21*). The internally directed branches are usually eight in number, exhibiting considerable diversity in their relations to the branches of the six cortical bundles of the pedicels. For example, cortical bundle no. 1 in *figs. 18-20* bifurcates laterally, one branch of which forms an internal strand. Cortical bundle no. 2 divides laterally and produces two internally directed strands, whereas cortical bundle no. 3 gives rise to no internal strands. To these eight peripheral strands, four additional strands are added from the central stele (blackened strands of *figs. 19-21*), making an outer ring of twelve strands in the part of the torus subtending the inner calyptra (*fig. 21*). These twelve bundles divide laterally (*fig. 22*), and some of them may be joined by a few tracheal elements to an average of five smaller internal bundles (unstippled strands of *figs. 20-22*) which depart from the stele at a higher level than the four bundles referred to above. The five smaller internal strands, however, are only feebly and temporarily attached to the vascular system of the inner calyptra and subsequently extend upward through the torus (*fig. 23*). The lateral branches of the twelve bundles of the inner calyptra divide and anastomose laterally, giving rise to an indefinite number of small strands which enter the free part of the inner calyptra (*fig. 23*). Simultaneously with the lateral divisions, a few internally and upwardly directed branches are formed. Thus, at the bases of both the outer and the inner calyptras, a certain amount of vascular tissue remains in the torus to become traces or parts of traces for the succeeding appendages.

The basic pattern in the vascularization of the inner calyptra evidently consists of four sets of three traces. There are apparently four median

traces that are attached to the central dictyostele and four pairs of lateral traces that are joined to the cortical system of calycine bundles. Such an interpretation is strengthened by comparisons with the flowering axis of *Magnolia*, *Liriodendron*, and other Magnoliaceae, where complex systems of cortical bundles are characteristically present. In these magnoliaceous plants, the dorsal trace of the 3-veined carpels is attached to the central dictyostele, whereas the two lateral traces tie into the cortical system of vascular bundles. This indicates that the inner calyptra of *Himantandra* is composed of four fused appendages, and comparisons with homologous members of *Degeneria* demonstrate that it is a corolla. We are unable to follow Diels (5) in homologizing the calyptras of *Himantandra* with the bud-scales of *Michelia Figo* (Lour.) Spreng., since the scales of both vegetative buds and flower-buds are clearly of stipular origin in the Magnoliaceae.

In a former comparison between the floral axes of Degeneriaceae, Magnoliaceae, and Himantandraceae (Bailey and Smith, 1), we failed to recognize fully the vascular complexities of *Himantandra*. Subsequent detailed investigations of more abundant and adequate material have shown that this genus resembles the Magnoliaceae rather than *Degeneria*, although its vascular complexities appear to be less stereotyped and stable than in many Magnoliaceae. The flowering shoots and pedicels of *Degeneria* do not have complicating systems of cortical bundles.

STAMENS AND STAMINODES. The columnar region of the torus upon which the stamens and staminodes are borne contains the terminus of the increasingly complex network of vascular strands. The strands in this region of the torus comprise (1) upward extensions of the inwardly directed branches of the corollaceous vascularization (figs. 22, 23), (2) upward extensions of the bundles which become temporarily attached to this system, and (3) additional traces detached from the central dictyostele, which loses its identity as a cylinder by the branching, rebranching, and dispersal of its constituent bundles. Traces from the strands in the peripheral regions vascularize the outer staminodes and lower stamens. The upper stamens and inner staminodes have traces that arise from the dispersed bundles of the dictyostele. Three traces from three separate strands enter the base of each fertile microsporophyll and likewise a majority of the sterile ones. In the case of the broad outermost staminodes and the innermost awl-shaped ones, the traces are sometimes reduced to two or one.

The stamens of *Himantandra* are not differentiated into filament, anther, and connective, and are best described as much elongated, narrowly lanceolate sporophylls (fig. 25). This was recognized by Diels, who states (5: 129): "Es ist unangebracht, bei diesen Sporophyllen überhaupt von Konnektiv oder Anthere zu reden. Denn der Blattcharakter ist kaum gestört, . . ." Each microsporophyll bears two pairs of vertically elongated sporangia that are immersed beneath the abaxial surface of the sporophyll. Dehiscence is longitudinal and extrorse. In transverse sections cut at the level of the sporangia (fig. 5), the microsporophylls of *Himantandra* exhibit

close similarities to those of *Degeneria*, not only as regards their general topographical features, but also concerning specific peculiarities of their endothecia. Three veins enter the base of the microsporophylls as in *Degeneria*, but there is more extensive branching of the veins in the sporophylls of the Himantandraceae than in the much shorter microsporophylls of the Degeneriaceae. Although the details of the vascularization fluctuate considerably from flower to flower of different collections and from stamen to stamen of the same flower, the marginal veins rarely extend beyond the lower third of the sporophylls of *Himantandra* (fig. 25) and tend to anastomose with the median vein or its branches just above the level of the sporangia. The paired sporangia are situated between the median and marginal veins and thus, as in *Degeneria*, cannot be regarded as slightly displaced marginal, or terminal, structures. Furthermore, in the Himantandraceae, as in the Degeneriaceae, the veins and veinlets are not directed toward the sporangia and do not establish connections with the endothecia.

The staminodes of *Himantandra* resemble the microsporophylls in general form and texture (figs. 24, 26), but their median and lateral veins commonly exhibit less extensive branching. Furthermore, in the outermost broad sterile sporophylls and the innermost awl-shaped ones, the lateral veins frequently are much reduced in length or are absent. The sterile sporophylls resemble the fertile ones in having numerous spherical secretory cells, more or less abundant nests of sclereids, and in being devoid of peltate scales, which are such characteristic features of the other organs of the plant.

The occurrence of staminodes within the fertile microsporophylls has been noted in *Degeneria*, which, like *Himantandra*, differs from the Magnoliaceae in this respect (Bailey and Smith, 1). The fact that in *Himantandra* sterile microsporophylls occur outside, as well as inside, the fertile ones does not appear to be of great significance, as in all respects except their sterility these staminodes are similar to the stamens. To interpret the outer staminodes as petals, Sprague (7) seems to have no justification. Therefore, we are in agreement with Diels (5: 129) in interpreting these outer appendages as sterile microsporophylls.

The pollen of *Himantandra* is provided with a single germinal furrow and therefore is of the monocolpate type. As in the Magnoliaceae, the form and the dimensions of the pollen fluctuate during expansion and contraction of the grains. When fully expanded the pollen tends to be nearly spherical, with diameters of from 30 to 38 microns. As the tenuous floor of the furrow invaginates during contraction, the grains become ellipsoidal, whereas when it evaginates the outlines of the grains become triangular in certain planes of orientation. The exine is thin and comparatively homogeneous, but, as in the case of many of the so-called smooth exines of Magnoliaceae, it exhibits minute pits or granulations when examined under high magnification in lactic acid.

CARPELS. The young carpels, like the young leaves, of *Himantandra*

are adaxially folded, viz. conduplicate, but the margins and the ventral surfaces of the free parts of the carpels (*fig. 6*) commonly are less closely approximated than those of the immature leaves (*fig. 3*). The adaxially oriented margins at the base of the carpels are adnate to the cone-shaped apex of the torus (*fig. 7*). At this level of the floral axis, there is more or less lateral concrescence of carpels, a tendency which becomes markedly intensified during the development of the fruits. The free parts of the carpels between the level of adnation and the base of the style not infrequently remain open at anthesis (*fig. 4*). The glandular cells of the plumelike style (*figs. 13, 14*) extend downward along the free margins and adjacent ventral surfaces of the carpel to the level of attachment of the large, much flattened, anatropous ovule. A transverse section of this free open part of the carpel (*fig. 4*) resembles a transverse section of the megasporophyll of *Degeneria* except that the ovule is attached closer to the margins of the conduplicate carpels than are the numerous ovules of *Degeneria*. In the Degeneriaceae, one is concerned with a seemingly primitive, conduplicate, 3-veined megasporophyll of comparatively unmodified form, bearing numerous ovules on its adaxial or ventral surface and having stigmatic structures along its margins and adjacent parts of its free ventral surfaces. With the reduction in the number of ovules to a single one (rarely two) in *Himantandra*, there appears to have been a concomitant narrowing of the sterilized upper $\frac{3}{5}$ to $\frac{5}{7}$ of the megasporophyll. This style-like projection beyond the broader base of the sporophyll still exhibits a conduplicate structure in transverse sections and retains its stigmatic margins. It should be noted in this connection that the styles of the Magnoliaceae likewise exhibit a conduplicate structure.

The free dorsal surfaces of the carpels of *Himantandra* are coated below the level of the style with numerous dark brown peltate scales (*figs. 4, 7, 11, 13, 14*). The abaxial parts of the carpels contain more or less numerous nests of sclereids, such as occur in the tissue of the torus (*fig. 7*). Spherical secretory cells are of common occurrence in the carpels, as in other parts of the flower. The level of attachment and the orientation of the large, much flattened, anatropous ovule fluctuate considerably from carpel to carpel and from flower to flower of different collections of *H. Belgraveana*. Thus, the ovule may be attached at a higher level where the carpel is open (*fig. 4*), or at a lower one where the carpel is adnate to the torus.

The vascular system in the cone-shaped, carpel-bearing, apical part of the torus is simple in contrast to its complexity in subtending regions. The vascular strands remaining after departure of traces to fertile and sterile microsporophylls briefly reassemble at the top of the columnar part of the torus into a weakly defined cylinder of bundles, most of which are dorsal bundles of carpels. The dorsal traces of all of the carpels, except the 2 or 3 distal ones, enter the megasporophylls without branching. A variable number of bundles (4-8) left in the center of the torus divide in various ways to form two (rarely one) small ventral traces for each of the carpels. The dorsal bundles of the 2 or 3 uppermost carpels arise also from these

central strands, but these dorsals first give off ventral traces to lower carpels of the same orthostichies. The carpel of *Himantandra*, therefore, is a modified 3-veined megasporophyll having a well-developed dorsal vein and two more or less reduced ventral ones. The dorsal vein extends upward as far as the middle or lower third of the style. It is much enlarged for a short distance in the region of the junction of the style and ovary. The ventral veins occasionally terminate in the ovule (especially when one ventral only is present), but usually they continue short distances in the margins of the carpels above the attachment of the ovule (fig. 14). However, the ventral veins rarely if ever extend upward into the style.

FRUIT. Soon after anthesis, the styles apparently atrophy and the basal portions of the carpels become increasingly concrescent. The mature fruit is a subglobose or somewhat elongated syncarp, upon the surface of which the outlines of the outermost imbricate carpels can be only indistinctly, if at all, perceived. The whole exterior surface is more or less persistently lepidote. The lower carpels appear shorter than those at the apex of the fruit, the constituent carpels being irregular in shape and apparently often distorted by mutual pressure. The original conical apical portion of the torus elongates, carrying the distal carpels upward and thus somewhat distorting the spiral arrangement. Sometimes the carpels are 2- or 3-ranked and strictly superposed.

All of the fruits available to us are dried, in which condition they are hard and coriaceous; according to Diels (5: 129) they are fleshy when fresh and somewhat suggestive of the syncarps of *Annona*. The inner walls of the carpels thicken after anthesis and in dried fruits form coriaceous dissepiments. During development of the fruit the carpels are apparently under lateral pressure, and the locules eventually appear as mere slits, much narrower in proportion than they are in the flower (fig. 7). The seeds, in all specimens examined by us, are solitary, greatly flattened, submembranous and suborbicular. In dried material we have not been able to perceive whether such seeds are fertile, and for the present we can neither add to nor verify Diels' statements (5: 130).

RELATIONSHIPS OF THE HIMANTANDRACEAE. In studying the relationships of families, it is essential to weigh evidence from all organs and parts of the plants. In the past, excessive emphasis has not infrequently been placed upon similarities between one or two morphological features without regard to outstanding differences in other parts of the plants, or conversely to stress differences in one organ or tissue without allowing for similarities in other organs or tissues. It should be noted in this connection that certain of the morphological similarities within the Ranales appear to be due to retentions of structures that characterized the primitive ranalian stock, whereas others represent parallel specializations from a common ancestry. Thus, the retention of vesselless xylem, in itself, does not provide adequate evidence for combining *Trochodendron*, *Tetracentron*, and the Winteraceae in an independent order, viz. Homoxylées of van Tieghem (9). Nor are the specialized calyptrate structures of *Drimys*,

Eupomatia, and *Himantandra* necessarily indicative of close relationship. Furthermore, certain superficial similarities or differences between specific organs prove to have been misleading when the ontogeny and the internal structure of these organs are carefully investigated.

There are numerous similarities between the Degeneriaceae, Magnoliaceae, and Himantandraceae. Many of these similarities (e. g. presence of spherical secretory cells, sclerenchymatous medullary diaphragms, stratified phloem, wood fibers with small bordered pits, superficial origin of periderm, monocolpate pollen, stomata with subsidiary cells oriented parallel to the guard cells, etc.), taken independently, are not necessarily indicative of close relationships, since they occur in other representatives of the Ranales. However, the *totality* of the similarities does indicate that the three families are more closely related to one another than to other ranalian families. In fact, the three families form a compact group within the Ranales comparable to that composed of the Monimiaceae, Lauraceae, Gomortegaceae, and Hernandiaceae.

The structure of the stem, including the cortex, pith, and vascular tissues, is of a basically similar type in the Degeneriaceae, Magnoliaceae, and Himantandraceae, and differs markedly from that which occurs in other ranalian families, with the possible exception of the Annonaceae. The wood of *Degeneria* is of a comparatively primitive type, whereas that of *Himantandra*, with its transitions to porous perforations and alternate lateral pitting of the vessels, is obviously more highly specialized. The woods of the numerous representatives of the Magnoliaceae provide a graded series of transitions between these structural extremes. However, the range of morphological variability of the stem is no greater than in single families or even genera of the dicotyledons and therefore, by itself, does not provide cogent arguments for differentiating the plants into three families or even for excluding them from close relationship to the Annonaceae.

The vascularization of the leaf in the Degeneriaceae, Magnoliaceae, and Himantandraceae is of a characteristic and basically similar type and serves to differentiate the three families from other ranalian families (including the Annonaceae) which have secretory cells and monocolpate pollen. Throughout the Magnoliaceae the vascularization of the foliar organs is complicated by the presence of stipules and provides a reliable means for differentiating the vegetative shoots of magnoliaceous plants from those of *Degeneria* and *Himantandra*. The peltate scales, crystalliferous parenchyma, and peculiar stomatal arrangements of *Himantandra* differentiate its vegetative organs from those of *Degeneria* and the Magnoliaceae. It should be admitted, however, that such differences in the vegetative organs, by themselves, do not afford a thoroughly reliable argument for segregating the plants into separate families rather than into tribes of a single family. Only when combined with outstanding differences in the reproductive organs is there a summation of evidence in favor of separate families.

The flowers of *Degeneria* and *Himantandra*, as of *Michelia* and *Elmer-*

rillia, are borne at the apex of axillary shoots. These shoots, as the terminal flowering ones of *Magnolia* and *Liriodendron*, are essentially vegetative, since they exhibit various stages in the reduction of typical leaves to scales (*Himantandra*) or to stipular bud-scales (Magnoliaceae). The flowers of *Degeneria* and *Himantandra* have clearly differentiated pedicels, whereas those of the Magnoliaceae are sessile on the last vegetative node. The flowers of *Degeneria* are provided with distinct sepals and petals, those of *Himantandra* with a calyptrate corolla enclosed within a calyptrate calyx, and those of the Magnoliaceae with tepals or subsimilar sepals and petals. The tepals of the Magnoliaceae usually have a conspicuously petaloid texture and internal structure, whereas the homologous parts of *Degeneria* and *Himantandra* are coriaceous and provided with very numerous nests of sclereids. The immature flowers of the latter genera are not enclosed within a bud, whereas those of the Magnoliaceae are enveloped within one or more pairs of stipular bud-scales.

There are no staminodes in the flowers of Magnoliaceae, whereas *Degeneria* has numerous inner staminodes and *Himantandra* both inner and outer ones. The microsporophylls of *Degeneria* and *Himantandra* are not differentiated into filament, anther, and connective, and their sporangia are immersed beneath the abaxial surface of the sporophyll. On the contrary, the microsporophylls of the Magnoliaceae are typical stamens with conspicuous protuberant anthers, but they tend to retain the 3-veined type of vascularization that characterizes both the fertile and sterile sporophylls of *Degeneria* and *Himantandra*.

The floral axis of the Degeneriaceae and Himantandraceae, unlike that of most Magnoliaceae, is short, and the torus is characterized by having a conspicuous concavity. In *Himantandra* the cone-shaped, carpel-bearing apex of the torus projects beyond this concavity, whereas in *Degeneria* the solitary carpel is attached within it. In the latter genus, the carpel is a 3-veined, conduplicate megasporophyll of relatively unmodified form, bearing numerous ovules on its morphologically adaxial surface. The attachment of the ovules is remote from the free stigmatic margins of the sporophyll. The numerous (rarely reduced to two, e. g. *Pachylarnax*) carpels of *Himantandra* and the Magnoliaceae have well-differentiated styles, which are plume-like in *Himantandra* and commonly provided with more or less decurrent stigmatic surfaces in Magnoliaceae. As contrasted with *Degeneria*, the ovules are reduced in number, commonly to one in *Himantandra* or to two in many representatives of the Magnoliaceae. Such morphological divergences are impressive, but a detailed study of the carpels of *Himantandra* indicates that they probably represent specializations of the 3-veined, conduplicate type of carpel encountered in *Degeneria*. With reduction in the number of ovules to one or a few more or less basally attached ones, there appears to have been a concomitant narrowing of the upper sterilized part of the conduplicate megasporophyll, forming styles which retain a conduplicate structure and stigmatic margins. Reduction of the "decurrent" stigmatic surfaces in certain of the Magnoliaceae

leads to the formation of a style with a nearly apical stigmatic surface. In *Himantandra*, as in many Magnoliaceae, there is more or less adnation and concrescence of carpels both preceding and following anthesis. In *Degeneria*, part of the maturing seeds are attached by slender much elongated funicles, suggestive of the suspended seeds of certain Magnoliaceae. The pollen of the Degeneriaceae, Magnoliaceae, and Himantandraceae is of a similar monocolpate type, that of *Himantandra* more closely resembling the pollen of certain Magnoliaceae than of *Degeneria*.

Outstanding differences in the carpel, calyx, and corolla render difficult the inclusion of *Degeneria* and *Himantandra* in a single family, in spite of obvious similarities in the form of the floral axis, the stamens, and the staminodes. Furthermore, numerous floral differences form a serious obstacle to including these genera in the Magnoliaceae. Aside from certain similarities in the pollen, in the vascularization of the stamens, and in the carpels of *Himantandra*, there is scant floral evidence for inferring close relationship to the Magnoliaceae. Such evidence is amply provided, however, by the vegetative organs. Thus, the summation of evidence from both vegetative and reproductive organs indicates that in the Degeneriaceae, Himantandraceae, and Magnoliaceae we are concerned with three distinct but closely related families. As will be shown in subsequent papers, similar summations of evidence indicate that such ranalian plants as the Winteraceae, *Illicium*, the Schizandraceae, and *Tetracentron* are only remotely related to this compact group of three families. To include them within the Magnoliaceae, as some investigators have done, broadens this family even beyond the limits of a natural sub-order.

PRINCIPAL LITERATURE CITED

1. BAILEY, I. W., and A. C. SMITH. Degeneriaceae, a new family of flowering plants from Fiji. Jour. Arnold Arb. **23**: 356-365. *pl.* 1-5. 1942.
2. BAKER, E. G. Himantandraceae (of Dr. H. O. Forbes's New Guinea Plants). Jour. Bot. **61**: Suppl. 2-3. 1923.
3. DIELS, L. Ueber primitive Ranales der australischen Flora. Bot. Jahrb. **48**: Beibl. **107**: 7-13. 1912.
4. ——— Die Anonaceen von Papuasien. Bot. Jahrb. **49**: 113-167 (*Himantandra*, pp. 164-165. *f. 6*). 1912.
5. ——— Ueber die Gattung Himantandra, ihre Verbreitung und ihre systematische Stellung. Bot. Jahrb. **55**: 126-134. *f. 1*. 1917.
6. McLAUGHLIN, R. P. Systematic anatomy of the woods of the Magnoliales. Trop. Woods **34**: 3-39. 1933.
7. SMITH, A. C. A nomenclatural note on the Himantandraceae. Jour. Arnold Arb. **23**: 366-368. 1942.
8. SPRAGUE, T. A. *Galbulimima baccata* F. M. Bailey. Hook. Ic. Pl. **31**: *pl.* 3001. 1915.
9. TIEGHEM, P. VAN. Sur les dicotylédones du groupe des Homoxylées. Jour. de Bot. **14**: 259-297, 330-361. 1900.

EXPLANATION OF PLATES

All plates illustrate *Himantandra Belgraveana* (F. v. Muell.) F. v. Muell. The figures are photographed from or drawn from various specimens, these being indicated in each case.

PLATE I

FIG. 1. *Clemens 6584a*. Dorsal surface of partially cleared leaf, showing peltate scales and crystal-bearing cells of the epidermis, $\times 260$. FIG. 2. *Brass & Versteegh 11195*. Lower epidermis of fully cleared leaf, showing circular clusters of stomata, $\times 260$.

PLATE II

FIG. 3. *Clemens 5538*. Transverse section of young conduplicate leaf, $\times 34$. FIG. 4. *Clemens 11100*. Transverse section of flower above the level of adnation of the conduplicate carpels, showing free stigmatic margins and the attachment of an ovule, $\times 100$. FIG. 5. *Brass & Versteegh 11195*. Transverse section of a fertile microsporophyll, showing embedded sporangia and four short arcs of endothecia, $\times 100$.

PLATE III

FIG. 6. *Clemens 3678*. Transverse section of immature flower, showing open conduplicate carpels, $\times 37$. FIG. 7. *Brass & Versteegh 11195*. Transverse section of older flower, showing adnation and coalescence of carpels, $\times 37$.

PLATE IV

FIG. 8. *Ledermann 10884a*. Transverse section of basal part of the midrib, showing foliar vascular dictyostele, $\times 50$. FIG. 9. *Y. U. 15717*. Transverse section of secondary xylem from a large stem, $\times 50$. FIG. 10. *Y. U. 15717*. Tangential longitudinal section of the same piece of wood, $\times 50$.

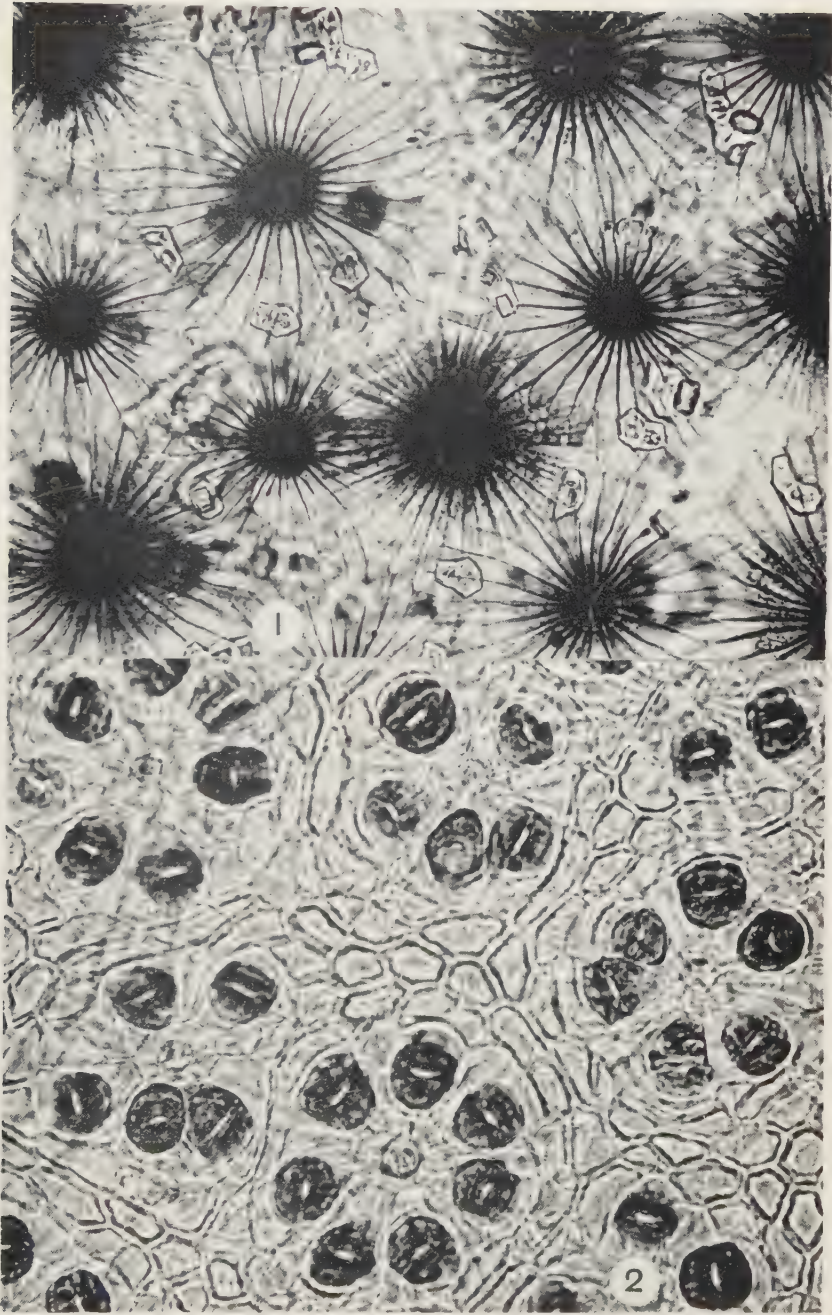
PLATE V

FIG. 11. *Brass 12103*. Flower with calyptrate calyx, calyptrate corolla, staminodes and stamens removed, approx. $\times 10$. FIG. 12. Half of same flower as in fig. 11, viewed from cut surface, showing shape of torus and attached lower and distal carpels, approx. $\times 10$. FIG. 13. *Clemens 3586*. Carpel with short and comparatively smooth style, approx. $\times 15$. FIG. 14. Carpel from flower of fig. 11, showing plumose style, position of ovule (micropyle, *micr.*), ventral bundle, *ven. bn.*, and ovule trace, *ov. tr.*, approx. $\times 15$.

PLATE VI

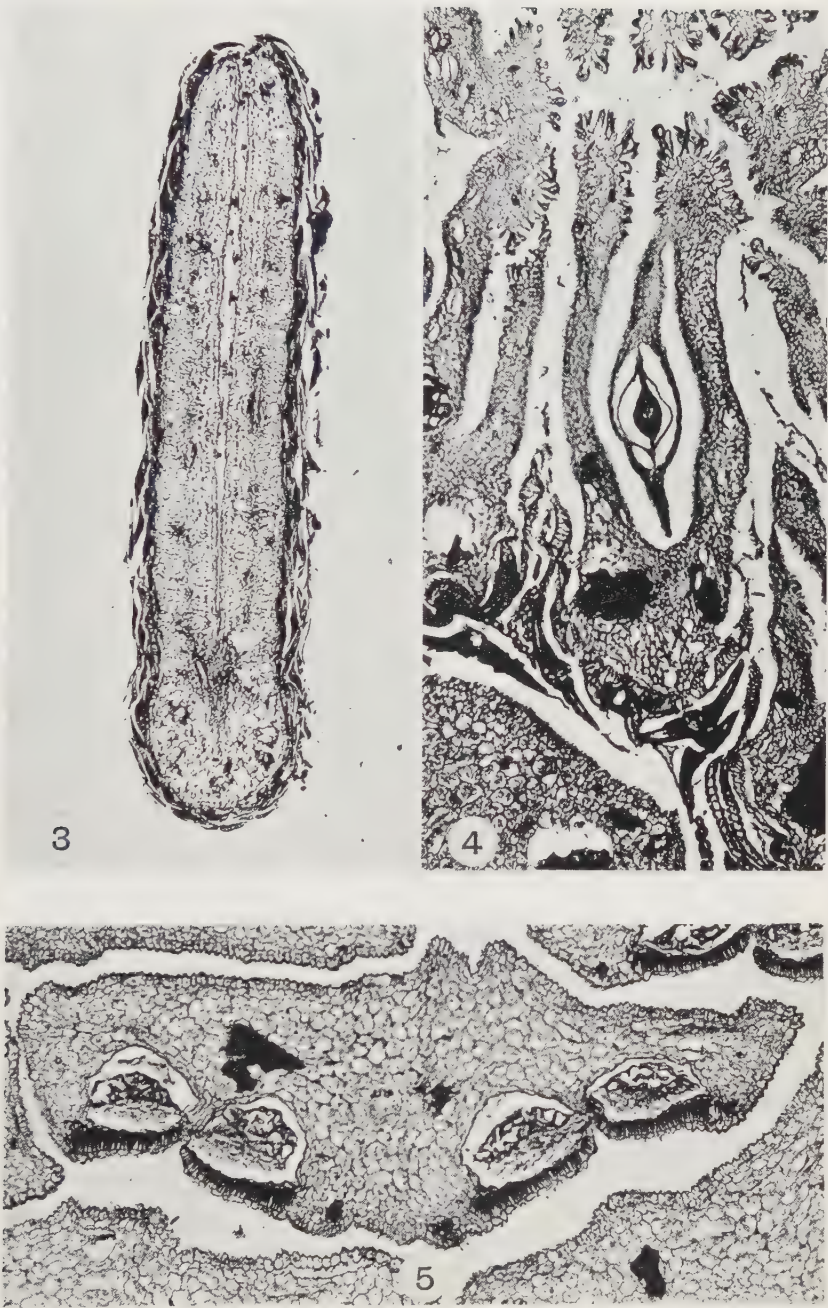
FIGS. 15-23. Diagrams of successive segments through flowering shoot and base of torus, showing average or basic vascular condition in *Himantandra*. Lower bract traces, *lo. br. trs.*; upper bract traces, *up. br. trs.*; bud trace, *bu. tr.*; cortical bundles, *cor. bn.*; outer calyptra, *o. cal.*; inner calyptra, *in. cal.* FIG. 24. *Brass 12572*. Outer staminode, approx. $\times 6$. FIG. 25. *Brass 12572*. Stamen, approx. $\times 6$. FIG. 26. *Brass 12572*. Inner staminode, approx. $\times 6$.

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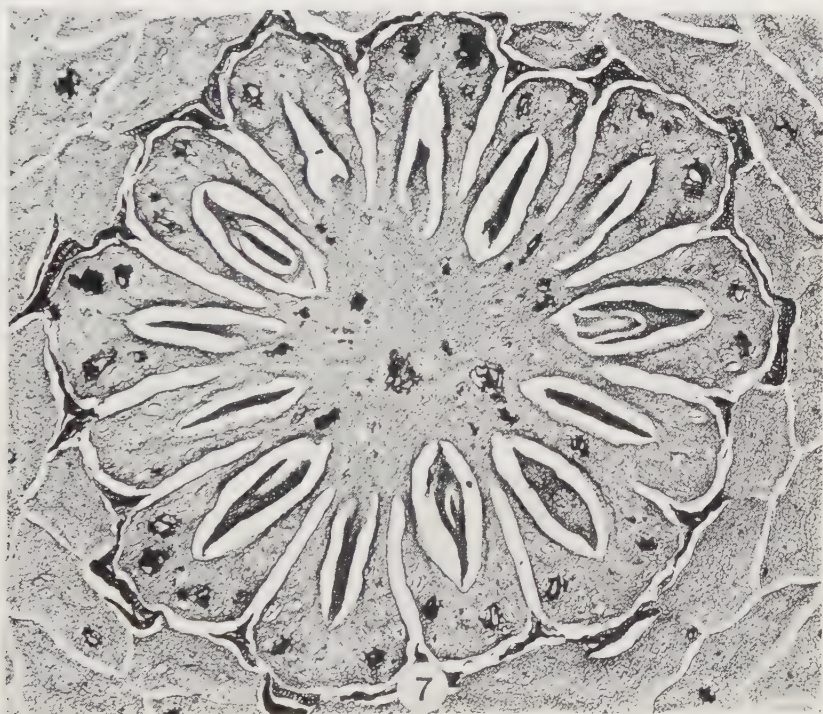
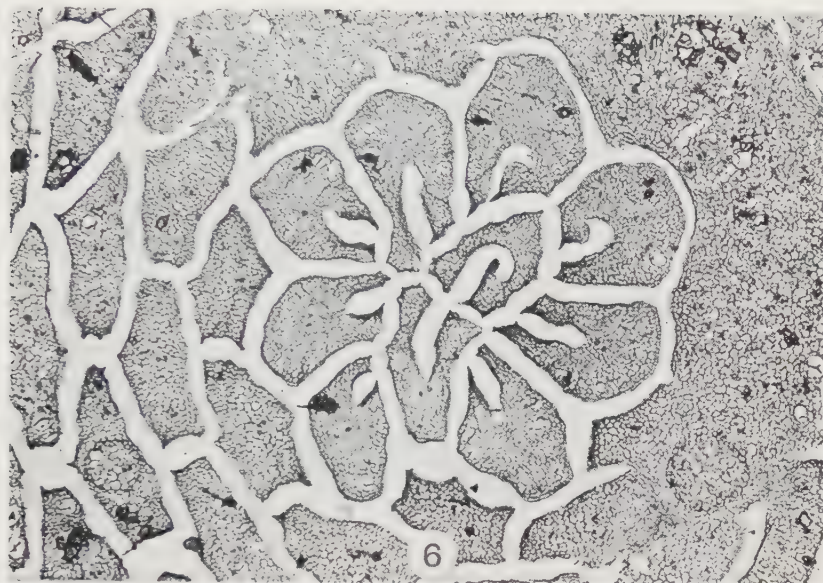
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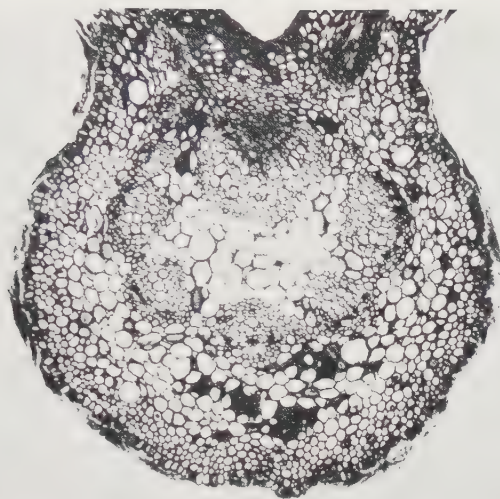
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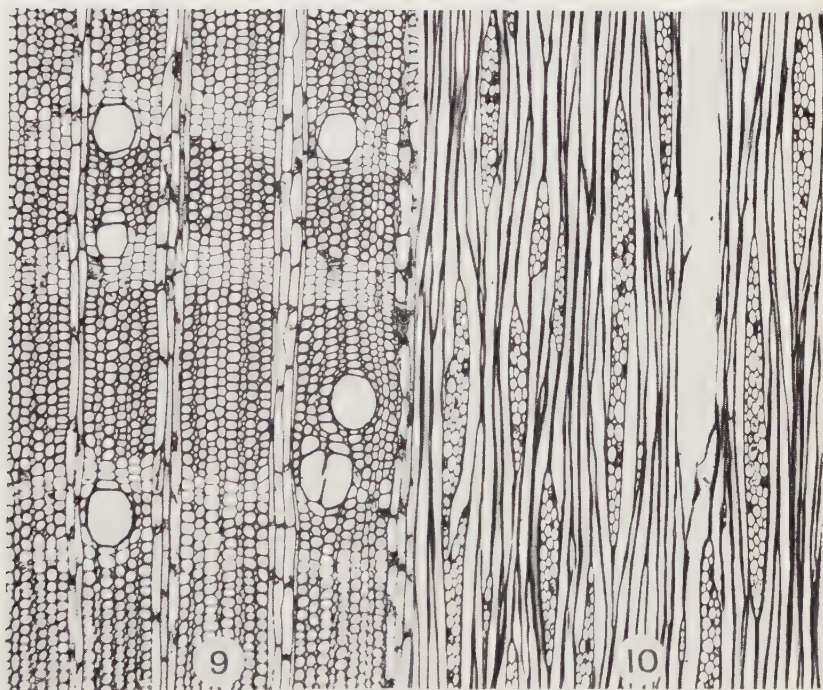


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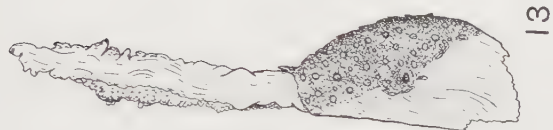
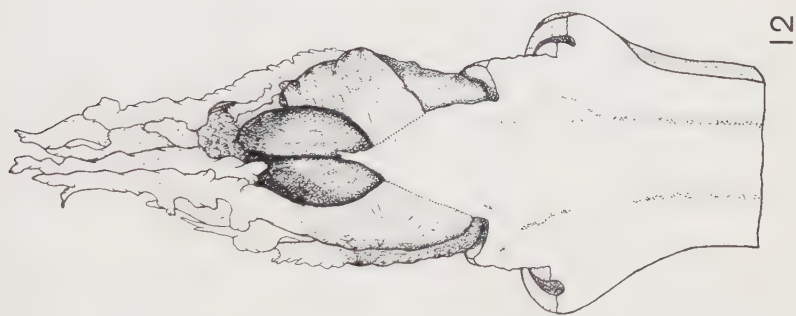
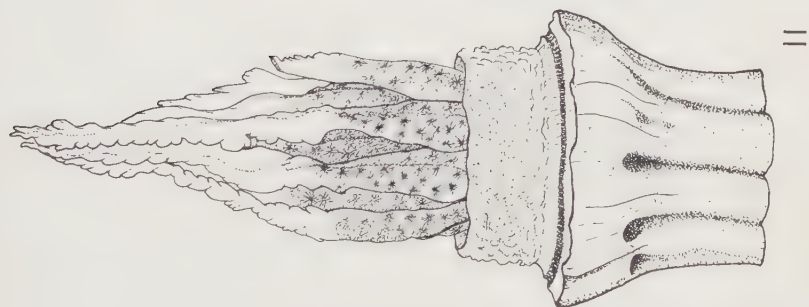


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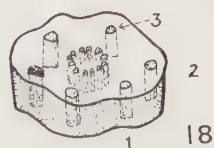
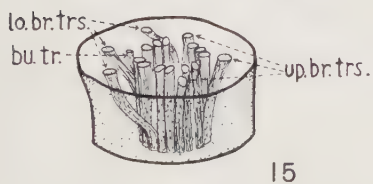
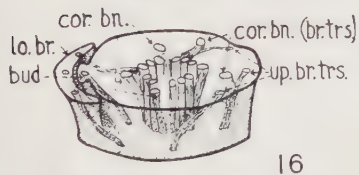
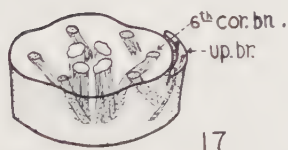
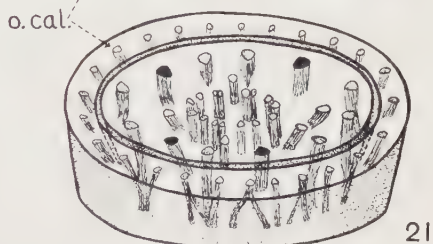
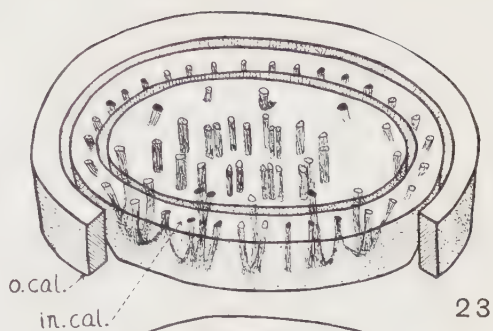
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HIMANTANDRA BELGRAVEANA











PLANTAE PAPUANAE ARCHBOLDIANAE, XII*

E. D. MERRILL AND L. M. PERRY

IN continuation of our work on the plants collected by the Archbold Expeditions in New Guinea, this article consists of a miscellany of notes and a few new species in the Cruciferae, Violaceae, Passifloraceae and Apocynaceae.

CRUCIFERAE

Cardamine Linnaeus

Cardamine papuana (Lauterb.) O. E. Schulz, Bot. Jahrb. **55**: 271. 1918.

Cardamine africana subsp. *borbonica* var. *papuana* Lauterb. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee Nachtr. 271. 1905.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass* 12164, January 1939, alt. 1600 m., rain-forest, common on rocks in small streams (tufts 15–25 cm. high; flowers white); 6 km. southwest of Bernhard Camp, Idenburg River, *Brass* 12922, February 1939, alt. 1500 m., banks of a forest stream. BRITISH NEW GUINEA: Mafulu, *Brass* 5540, September–November 1933, alt. 1250 m., wet rocks of a forest stream, rare (flowers white).

We have accepted Schulz's designation of the Papuan material. Whether it is really more than a localized form of the wide-ranging *Cardamine africana* L. is impossible to determine with our limited collections.

Cardamine altigena Schlechter ex Schulz, Bot. Jahrb. **62**: 479. 1929.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass* 9285, August 1938, alt. 3225 m., with *Marchantia* in a long-grass marsh (flowers white); same locality, *Brass* 9472, on a mossy bank; 9 km. northeast of Lake Habbema, *Brass* 10553, October 1938, alt. 2800 m., stony bed of a stream, rare; 7 km. northeast of Wilhelmina-top, *Brass* & *Myer-Drees* 10026, September 1938, alt. 3560 m., wet grassy cliffs, rare.

Siliques 1.5–2 cm. long, 0.2 cm. wide, attenuate into a style 1–2 mm. long; stigma 0.5 mm. broad; seeds oblong, 1.6 mm. long, 1 mm. wide.

Papuzilla Ridley

Papuzilla minutiflora Ridley, Trans. Linn. Soc. II. Bot. **9**: 17. *t.* 1, figs. 7–14. 1916; Schulz, Nat. Pflanzenfam. ed. 2, **17b**: 275, 410. 1936.

NETHERLANDS NEW GUINEA: 2 km. east of Wilhelmina-top, *Brass* & *Myer-Drees* 9986, 10334, September 1938, alt. 3800 m., alpine grassland, massed on limestone rocks, also wet open places along small waterfall (flowers greenish to violet and white); northern slopes of Mt. Wilhelmina, *Brass* & *Myer-Drees* 10053, alt. 3900 m., prostrate in dense mats or forming loose cushions on screes (flowers and fruits purple).

Since the genus appears to be known only from the type-material of the species, we have placed these collections on record. They agree pretty well with the plate of the original material, but the pubescence of the stem varies from minutely pubescent to glabrous, and the leaves are often 7–9-incised-dentate.

*Botanical Results of the Richard Archbold Expeditions. See Jour. Arnold Arb. **24**: 34–59. 1943.

VIOLACEAE

Rinorea Aublet

Rinorea fasciculata (Turcz.) Merr. Philip. Jour. Sci. Bot. **12**: 286. 1917, Enum. Philip. Fl. Pl. **3**: 104. 1923.

Pentaloba fasciculata Turcz. Bull. Soc. Nat. Mosc. **27**(2): 341. 1854.

SOLOMON ISLANDS: **Florida** (N'Gela): northern end of island, *Brass* 3509, January 1933, alt. 75 m., hill rain-forests (slender small tree with thin brown bark and hard yellow wood; leaves dull dark green, all the tips destroyed by insects; flowers yellow-green).

This specimen compares reasonably well with the isotype in our herbarium. In the latter the anthers are a little larger and, in part of the inflorescences, the pedicels are scarred at the base, but this may be owing to the age of the growth. The inflorescences on the year old twigs have pedicels apparently scarred at the base; the scarred part we take to be the very short persistent axis of the old inflorescence. In the collection from the Solomon Islands the inflorescences are all on new growth and do not show this character.

Rinorea salomonensis (Rechinger) Melchior, Nat. Pflanzenfam. ed. 2, **21**: 352. 1925.

Alsodeia salomonensis Rechinger, Rep. Sp. Nov. **11**: 184. 1912, Denkschr. Math.-Nat. Kl. Akad. Wiss. Wien **89**: 579. t. 6, f. 11 B. 1913.

SOLOMON ISLANDS: **Bougainville**: Karngu, Buin, *Kajewski* 2295, October 1930, alt. 50 m., rain-forest, common (medium-sized tree up to 15 m. high; petals white with cream-colored edges; fruit somewhat triangular, 6 mm. long, 7 mm. diameter, with small appendage 2 mm. long).

In the specimen above cited there are, on the lower surface, minute tufts of brownish hairs in the axils between the primary veins and the midrib. The petals, about 5 mm. long, in full grown flowers are about twice as long as the sepals. The fruit has reticulate valves with 3 mottled brown seeds about 4 mm. in diameter. In general habit the species closely resembles *Rinorea carolinensis* Kaneh., as pictured in Bot. Mag. Tokyo **48**: 922. f. 8. 1934, but the anther-appendages are different; in the former they are simply acute at the apex, not lobed or erose as in Kanehira's species.

Hybanthus Jacquin

Hybanthus enneaspermus (Linn.) F. v. Muell. Fragm. Phytogr. Austr. **10**: 81. 1877, Pap. Pl. **2**: 4. 1885.

Viola enneasperma Linn. Sp. Pl. **1**: 937. 1753.

Ionidium enneaspermum Vent. Jard. Malm. sub 27. 1803-04; Merr. Enum. Philip. Fl. Pl. **3**: 106. 1923.

BRITISH NEW GUINEA: Western Division, Penzara, between Morehead and Wassi Kussa Rivers, *Brass* 8434, December 1936, occasional on savanna-forest ridges.

The species has once before been reported from New Guinea, but modern workers on the family in this region seem to have overlooked the record. The species is also reported from the Philippines under *Ionidium*.

Agatea A. Gray

Agatea macrobotrys Lauterb. & K. Schum. Fl. Deutsch. Schutzgeb. Südsee 453. t. 14. 1900; Melchior, Nat. Pflanzenfam. ed. 2, **21**: 360. f. 157 D. 1925, Bot. Jahrb. **62**: 373. 1929.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 14057*, April 1939, alt. 50 m., flooded rain-forests of river plain (large climber in dense marginal growths of forest; flowers purple).

This specimen agrees with the original description in all details except that the ovary is sparsely hairy. In the previous records of this species only the type from Northeastern New Guinea has been cited.

Agatea salomonensis sp. nov.

Frutex scandens; ramulis maturis glabris novellis \pm pubescentibus; foliis chartaceis utrinque glabris manifeste reticulatis petiolatis, petiolo glabrato 2.5–3 cm. longo, stipulis minutis subulatis, lamina late ovata 7–11 cm. longa 5.5–7.5 cm. lata, basi rotundata apice acute breviterque acuminata margine subintegra vel minute denticulata, venis primariis utrinsecus 6 vel 7 utrinque manifestis; inflorescentiis axillaribus paniculatis \pm 20 cm. longis, rhachi ramulis pedicellisque \pm patenti-pubescentibus, bracteis bracteolisque minutis; sepalis circiter 2 mm. longis oblongis obtusis ciliatis; petalis ciliolatis: posterioribus oblongis 4 mm. longis, lateralibus 5 mm. longis 3 mm. latis, labello 8–9 mm. longo medio valde ligulato constricto 2 mm. lato, parte distali subdolabriformi \pm 6 mm. longa lataque emarginata extus glabra, intus apice et margine lato involuto excepto villosa, parte basali gibboso-saccata intus basi excepta villosa margine valde undulato; filamentis brevissimis 1 mm. longis connatis utrinque pubescentibus 2 anterioribus extus glandulosis vel tuberculatis, antheris 1 mm. longis, extus connectivo inter loculos pilosis, apice anguste appendiculatis, connectivo in appendicem petaloideam 1.5 mm. latam 2 mm. longam producto; ovario globoso ad basim piloso; fructibus immaturis.

SOLOMON ISLANDS: Bougainville: Karngu, Buin, *Kajewski 2309* (TYPE), October 1930, alt. 50 m., rain-forest, common (vine climbing rain-forest trees; petals white, the labellum with a touch of purple).

Agatea salomonensis is closely allied to *A. macrobotrys* Lauterb. & K. Schum. The flowers are larger, the pubescence of the inflorescence is more shaggy, the leaves are much more shortly acuminate or scarcely more than acute.

Viola Linnaeus

Viola betonicifolia Sm. subsp. *nepalensis* (Ging.) W. Becker, Bot. Jahrb. 54, Beibl. 120: 166. 1917; Melchior, Bot. Jahrb. 62: 374. 1929.

NETHERLANDS NEW GUINEA: Balim River, *Brass 11653*, December 1938, alt. 1600 m., occasional on grassy deforested slopes (flowers pale, almost white).

This species is widespread from the Himalayas southward, but it has not previously been reported from Netherlands New Guinea.

Viola lunata Ridl. Trans. Linn. Soc. II. Bot. 9: 17. 1916; Melchior, Bot. Jahrb. 62: 374. 1929.

NETHERLANDS NEW GUINEA: Southern slopes of Grand Valley, *Brass 9521* (coll. *Toxopeus*), August 1938, alt. 2350 m.; 9 km. northeast of Lake Habbema, *Brass 10732*, October 1938, alt. 2800 m., plentiful in herbaceous cover of a native clearing in the forest (ascending and spreading; flowers pale, almost white); Bele River, 18 km. northeast of Lake Habbema, alt. 2200 m., abundant on wet grassy banks of river (flowers pale). BRITISH NEW GUINEA: Murray Pass, Wharton Range, *Brass 4656*, July 1933, alt. 2840 m., among *Sphagnum* in a grassland hollow (small creeping herb); same locality, *Brass 4756*, on banks of stream (flowers pale purple); Vanapa Valley,

Urunu, *Brass* 4800. August 1933, rare in swampy hollows on open grassland (flowers pale purple, marked with darker lines).

Apparently fairly common in the mountains of New Guinea; recorded by Melchior from the Arfak Mountains, the Carstensz Range (type-locality) and Mount Sarawaket.

Viola diffusa Ging. subsp. *tenuis* (Benth.) W. Becker, Philip. Jour. Sci. **19**: 714. 1921; Merr. Enum. Philip. Fl. Pl. **3**: 105. 1923.

Viola tenuis Benth. in Hook. Lond. Jour. Bot. **1**: 482. 1842.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass* 11469, November 1938, alt. 2200 m., rare herb growing under *Imperata* on formerly cultivated slopes (flowers pale violet). Southern China, Formosa, Philippines.

The only collection of this subspecies we have seen is a probable topotype from Hongkong. The New Guinean material differs in being a plant with smaller leaves and somewhat more narrowly winged petioles longer than the leaf-blades; the flower, however, seems to agree reasonably well with the description of that of the species.

PASSIFLORACEAE

Hollrungia K. Schumann

Hollrungia aurantioides K. Schum. Bot. Jahrb. **9**: 212. 1888; K. Schum. & Hollr. Fl. Kaiser Wilhelms Land **82**. 1889; K. Schum. & Lauterb. Fl. Deutsch. Schutzg. Südsee **456**. 1900; Harms, Nat. Pflanzenfam. **3**(6a): 86. fig. 25, *E*, *F*. 1893; Harms, op. cit. ed. 2, **21**: 495. fig. 218, *E*, *F*. 1925.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass* 12880, February 1939, alt. 1200 m., rain-forest canopy liane.

Apparently otherwise known only from the type-material collected in Northeastern New Guinea.

APOCYNACEAE

The study of the Apocynaceae has brought to light some range-extensions and a few new species. *Carruthersia*, a Polynesian and Philippine genus, is reported for the first time from the Solomon Islands, and *Bleekeria* Hasskarl has been re-established.

Clitandropsis S. Moore

Clitandropsis novo-guineensis (Wernh.) S. Moore ex Markgr. Nov. Guin. **14**: 279. 1926; Markgr. Bot. Jahrb. **61**: 174. 1927.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass* 11441. BRITISH NEW GUINEA: Mafulu, *Brass* 5253; Tarara, *Brass* 8676. NORTHEASTERN NEW GUINEA: Morobe District, *Clemens* 3914, 4523, 5266, 5419, 5443, 6462, 11096. SOLOMON ISLANDS: Bougainville: Koniguru, Buin, *Kajewski* 2075, October 1930, alt. 900 m., common in rain-forest (flowers cream-colored, strongly scented; fruit greenish yellow, ovoid, 4 × 2.3 cm.); Guadalcanal: Uulolo, Tutuve Mountain, *Kajewski* 2572, 2614, April 1931, alt. 1200 m., rain-forest, common (vine climbing well into the tops of rain-forest trees; fruit orange, 4 cm. long, with a sharp apex, 2 cm. diam.).

For the present we are assigning all these collections to *Clitandropsis novo-guineensis* (Wernh.) S. Moore ex Markgr. In the Solomon Islands material the fruits are a little smaller, but we are not inclined to do more than give a provisional determination at present. We have not found the

generic lines as drawn between *Melodinus*, *Clitandropsis* and *Pseudo-Willughbeia* very satisfactory in determining our rather scanty material.

Alstonia R. Brown

Alstonia macrophylla Wall. List no. 1648. 1829, nomen nudum; A. DC. Prodr. **8**: 409. 1844; vel aff.

SOLOMON ISLANDS: Bougainville: Kugumaru, Buin, *Kajewski* 1834, June 1930, alt. 150 m., rain-forest, common (medium-sized tree up to 20 m. high; follicles up to 50 cm. long).

This species is seemingly new for the Solomon Islands.

Alstonia longissima F. v. Muell. Pap. Pl. **5**: 91. 1877; Rehder in C. T. White, Jour. Arn. Arb. **10**: 260. 1929.

SOLOMON ISLANDS: Guadalcanal: Berande, *Kajewski* 2449, January 1931, sea-level, rain-forest, common (large tree up to 25 cm. high with very small buttresses; follicles 28 cm. long, 5 mm. diameter; timber used in making houses); San Cristobal: Kira Kira, *Brass* 3014, October 1932, coastal rain-forests, common (large tree with grey scaly bark; leaves thin, the midrib almost white).

The species was described from New Guinea and has since been reported from Queensland.

Alstonia Reineckeana Lauterb. Bot. Jahrb. **41**: 233. 1908; Stapf in Setchell, Amer. Samoa 58, *pl.* 12, *fig. A.* 1924; Christophersen, B. P. Bish. Mus. Bull. **128**: 177. 1935.

SOLOMON ISLANDS: Ysabel: Tiratona, *Brass* 3404, December 1932, alt. 600 m., rain-forest (small tree with shining leaves and cream-colored flowers); Guadalcanal: Uulolo, Tutuve Mountain, *Kajewski* 2575, April 1931, common in rain-forest (small tree up to 10 m. high, with showy white faintly scented flowers).

These flowering collections are a reasonably good match for *Christophersen* 1903 from Samoa (of which we have only a fruiting specimen) and also for Setchell's plate of this Samoan species. The leaves are larger than those of the original description but not larger than those of Christophersen's collection. They differ from the New Caledonian material of *Alstonia plumosa* Labill. in the chartaceous texture of the leaves, the slightly more remote lateral veins, and the tendency to larger flowers. Some *Kajewski* collections from the New Hebrides previously recorded as *Alstonia villosa* f. *calvescens* Markgr. are certainly of this alliance and probably conspecific.

Alyxia R. Brown

Alyxia floribunda Markgr. Bot. Jahrb. **61**: 184. 1927.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass* 11439, November 1938, alt. 2200 m., occasional in forest undergrowth on steep limestone slopes (large scrambling shrub; panicles white).

This is an entirely glabrous fruiting specimen which seems most like the above-named species. It differs from the isotype in that the branchlets are less definitely angled and the leaves are 3–8 mm. petiolate.

Alyxia pugio Markgr. Bot. Jahrb. **61**: 182. 1927.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass* 12060, January 1939, alt. 1800 m., mossy forest seral growths (slender scrambling shrub; flowers white).

Except for the broader and shorter leaves ($4-6 \times 1-3$ cm.), this collection suits the description of *Alyxia pugio* Markgr. from the mossy forest of the Sepik Territory.

Alyxia subalpina Markgr. Bot. Jahrb. **61**: 183. 1927.

NETHERLANDS NEW GUINEA: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass* 12180, 12627, January and February 1939, alt. 2100 and 2150 m., in shrub-beries of a steep summit; low stunted mossy forest (scrambling shrub 1.5 m. high; corolla orange-colored with yellow lobes; fruit unripe); 15 km. southwest of Bernhard Camp, Idenburg River, *Brass* 12361, January 1939, alt. 1700 m., epiphytic on a tall tree in mossy forest (shortly climbing slender shrub).

The first two cited collections vary from the original description in having slightly narrower leaves, longer peduncles (5-7 mm.) and pedicels (4-5 mm.), shorter corolla-tube (2.5 mm.), and shorter stigmatic appendages. These differences, however, are so small that they cannot be considered specific without actual comparison with the type-specimen. *Brass* 12361 differs in being more freely growing, with larger leaves and longer internodes, whereas the other two are compact with short branches. Possibly two species are represented, but, lacking flowers in the last number, we suspect that the contrast represents different phases of growth or age.

Alyxia fragrans sp. nov.

Frutex scandens; ramulis novellis puberulis; foliis quaternatim verticillatis glabris coriaceis anguste obovato-ellipticis, basi cuneatis breviter acutiusculis vel brevissime et obtuse acuminatis, 5-9 cm. longis 2.5-4.5 cm. latis, nervis lateralibus utrinque manifestis 2-3 mm. inter se distantibus rectis late patentibus; petiolo 5-9 mm. longo; inflorescentiis axillaribus paniculatis 13-(in fructu) 16 cm. longis 4 cm. latis, pedunculo \pm 7 cm. longo puberulo, ramulis 0.5-2.5 (in fructu 3) cm. longis pubescentibus angulatis; bracteis lanceolato-ovatis acutis 3 mm. longis interdum carinatis; lobis calycis ovatis 3.5 mm. longis subcarinatis extus pubescentibus intus glabris; corolla albida, tubo 4 mm. longo infra stamina 1 mm. et inter antheras piloso, lobis oblongis 1.5 mm. longis; staminibus in medio tubo insertis, filamentis circiter 0.4 mm. longis glabris, antheris lineari-oblongis 1.2 mm. longis apiculatis; stylo 1 mm. longo; stigmatibus ellipsoideo apice setoso, ovario dense piloso; fructu aurantiaco; mericarpiorum articulis 1 vel 2, ellipsoideis, \pm 16 mm. longis et 12 mm. crassis, stipite circiter 7 mm. longo.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass* 11577 (TYPE), 11300, November 1938, alt. 2350 m., scrambling in a forest opening and frequent in open undergrowth under oaks (large shrub; leaves stiff, convex; inflorescence white; flowers fragrant; fruit orange-colored).

This species is closely allied to *Alyxia scabrida* Markgr. but is readily distinguished by the considerably larger and fewer flowers of the inflorescence.

Alyxia Lamii Markgr. Nov. Guin. Bot. **14**: 280. 1926, Bot. Jahrb. **61**: 183. 1927, vel aff.

BRITISH NEW GUINEA: Mt. Tafa, *Brass* 5011, May-September 1933, alt. 2400 m., common throughout forests (slender high climbing liane; corolla-tube pale brown, the lobes cream-colored; fruits green).

The collection differs from *Brass* 12679 (from Netherlands New Guinea),

which we have accepted as typical, chiefly in its lack of pubescence; also the leaves are less revolute on drying. Lacking further material and the privilege of examining types, the determination can only be accepted provisionally.

Ochrosia Jussieu

Ochrosia glomerata (Bl.) F. v. Muell. Fragm. Phytogr. **7**: 130. 1871; Markgr. Bot. Jahrb. **61**: 191. 1927.

SOLOMON ISLANDS: *Ysa bel*: Tatamba, *Brass 3442*, January 1933, alt. 50 m., hill-forests, common (tall tree with brown fissured bark, yellow when cut; wood hard, yellow; leaves smooth and shining; flowers white).

This collection is a reasonably good match for one so determined by Valetton in 1912, cultivated at the Botanic Garden of Buitenzorg. According to Markgraf the species is known from the Philippines and New Guinea.

Bleekeria Hasskarl

Although, for the most part, we have accepted generic names in current usage, on account of the difficulty which we encountered in determining a fruiting specimen from the Solomon Islands we have looked into the nomenclatural problems of *Ochrosia* Juss. sensu lato. Markgraf, Bot. Jahrb. **61**: 192-194. 1927, in a reasonably adequate discussion of the generic limits of the genus, decided that the two sections of *Ochrosia* Juss. as accepted by Valetton (as subgenera) and by F. v. Mueller (as sections) possessed generic value. Retaining the epithet *Ochrosia* Juss. for one group, he proposed the new name *Excavatia* Markgr. for the other, the sectional name *Lactaria* not being acceptable as a genus on account of having been coined for the true *Ochrosia* Juss.; further, Markgraf indicated that all the names given as synonyms of *Ochrosia* Juss. were to be considered in the same way. In so doing, he must have overlooked the little mentioned but greatly detailed description of Hasskarl's genus *Bleekeria*, based according to Hasskarl himself on the species *Bleekeria calocarpa* "(e *Bleekeria kalokarpa sumptus*)."¹ Valetton, commenting on *Ochrosia calocarpa* Miq. (a transfer from Hasskarl's species), made this rather significant remark on the generic limits of *Bleekeria*: "introduisant toutefois dans la description du genre quelques-unes des propriétés qui n'appartiennent qu'à cette espèce." That is to say the type of the genus *Bleekeria* Hassk. has to be *Bleekeria calocarpa* Hasskarl, and the secondary application of this generic name to Rumphius' species is incidental and has nothing whatever to do with the typification of the genus. In addition, the fact that, four years later, Hasskarl considered the same two species under the genus name *Lactaria* is irrelevant, according to the present International Rules of Nomenclature. In 1923 Koidzumi, Bot. Mag. Tokyo **37**: 48-52, apparently divided *Ochrosia* Juss. into two parts, using the generic name *Lactaria* Rumph. for the true *Ochrosia* Juss. and *Bleekeria* Hassk. for the Section *Lactaria* F. v. Muell. (subg. Valetton). The name *Lactaria* Rumph. cannot supersede *Ochrosia* Juss., for it is a later designation first described by Rafinesque (1838) under the binomial system; but *Bleekeria* Hasskarl, Retz. **1**:

38–40. 1855, must replace *Excavatia* Markgraf, Bot. Jahrb. **61**: 194. 1927.

Bleekeria solomonensis sp. nov.

Arbor usque 15 m. alta glabra; ramulis teretibus novellis compressis; foliis oppositis vel ternatis chartaceis oblongis utrinque angustatis, 9–16 cm. longis 3.5–5.5 cm. latis, basi cuneatis apice subabrupte acuminatis, acumine 5–10 mm. longo acutiusculo, nervis lateralibus crebris subtransversis utrinque manifestis nervo marginali conjunctis; petiolo 1–1.5 cm. longo; inflorescentiis ternis in axillis verticilli summi foliorum; pedunculo communi \pm 1.5 cm. longo compresso vel subalato; alabastro tantum viso bracteato; lobis calycis 5 lanceolato-ovatis, apice obtusiusculis, intus non glandulosi, 2 mm. longis 1 mm. latis; tubo corollae 6 mm. longo, lobis 7 mm. longis invicem sese dextrorsum tegentibus; antheris vix 1.5 mm. longis lanceolatis, filamentis 0.5 mm. longis infra faucem insertis; stylo 2 mm. longo; stigmatibus turbinato-conico; fructu apocarpio, mericarpiis 2 ovoideis obtusis compressis in sicco versus apicem alatis, \pm 3.5 cm. longis et 2.5 cm. latis et 1 cm. crassis, obscure laxe reticulatis sub lente striate granulosis; excavationibus mesocarpii 2.2 cm. longis 0.5 cm. latis; semine unico elliptico plano 1.7 cm. longo 0.8 cm. lato.

SOLOMON ISLANDS: Bougainville: Kugumaru, Buin, *Kajewski 1859* (TYPE), June 1930, alt. 150 m., rain-forest, common (small tree up to 15 m. high; fruits boat-shaped, borne in pairs).

This species appears to be most like *Bleekeria mariannensis* (DC.) Koidz., but the latter has a narrower oblong fruit with more pointed apex and lateral wings. In *B. solomonensis* the dried fruit is winged at the apex and the wing extends down on both sides about $\frac{2}{3}$ of the length of the fruit.

Bleekeria minima (Markgr.) comb. nov.

Excavatia minima Markgr. in Merr. & Perry, Jour. Arnold Arb. **21**: 199. 1940.

Type-collection: *Brass 8512*.

Micrechites Miquel

Micrechites Archboldiana sp. nov.

Frutex scandens, ramulis ultimis et bracteis inflorescentiae puberulis exceptis glaber; foliis coriaceis 9–17 cm. longis 3–8 cm. latis ellipticis, basi late cuneatis vel obtusis apice acuminatis, acumine 1–1.5 cm. longo, nervis lateralibus utrinsecus 7–10 oblique adscendentibus, reticulo inconspicuo; petiolo 1–2 cm. longo; inflorescentiis axillaribus et terminalibus paniculatis, 8–15 cm. longis 6–10 cm. latis, 4- vel 5-dichotomis; ramulis ultimis brevissimis, bracteatis, bracteis rotundatis circiter 1 mm. magnis; lobis calycis rotundatis 1 mm. longis ciliolatis interdum puberulis; corolla hypocrateriformi, tubo inflato sub faucem paullo angustato, 3.5 mm. longo 1.5 mm. lato, lobis sinistrorsum obliquis, parte inferiore oblongis dextrorsum tegentibus, parte superiore linearibus undulatis 3.5 mm. longis, fauce dense barbatis; antheris 1.5 mm. longis, inclusis, filamentis 1.5 mm. supra basim tubi affixis usque ad basim corollae decurrentibus, glabris; stigmatibus conico basi annulo angusto cincto; ovario dense setuloso 1–1.5 mm. longo, disco quam ovario paullo brevior 5-partito; mericarpiis glabris cylindricis horizontaliter patentibus immaturis 9 cm. longis et 6 mm. crassis; seminibus lineari-oblongis 2 cm. longis 2.5 mm. latis erostratis apice coma brunnea 2–2.5 cm. longa coronatis.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass* 13071, 13401 (TYPE), March 1939, alt. 850 m., rain-forest, common (canopy liane; corolla yellow with red lobes; fruit immature).

The general habit of this species is like that of Markgraf's *Papuechites*, but the seeds are unbeaked, with a terminal coma, whereas those of *Papuechites* are narrowed into an elongated somewhat filiform beak covered with long spreading hairs.

Carruthersia Seemann

Carruthersia Brassii sp. nov.

Frutex scandens glaber vel consperse pilosus, ramulis teretibus; foliis oppositis ovato-ellipticis basi retusis vel leviter cordatis apice longiuscule acuminatis. 5–14 cm. longis 3–8 cm. latis, utrinque glabris (vel consperse pilosis) brunneis subdiscoloribus, nervis lateralibus utrinsecus 9–11 utrinque perspicuis patenti-adscententibus marginem versus arcuatim conjunctis, reticulo conferto subtus in sicco atro-brunneo; petiolo 1–2.5 cm. longo; inflorescentiis axillaribus terminalibusque 6–10 cm. longis, paniculatis. lobis calycis et bracteis ciliatis exceptis glabris; lobis calycis 1.5 mm. longis ovatis obtusiusculis intus pluriglandulosis; corolla hypocrateriformi fauce pubescente. tubo 9 mm. longo ad antheras paullum inflato extus glabro intus pubescente. lobis dextrorsum tegentibus 7–8 mm. longis 4 mm. latis, obliquis: staminibus circiter 2 mm. supra basim tubi insertis, filamentis vix 1 mm. longis pubescentibus, antheris circiter 2 mm. longis apiculatis liberis; disci squamulis tantum 2 oppositis inter carpida; ovario apocarpio; stylo 1 mm. longo, stigmatibus anguste conoideo.

SOLOMON ISLANDS: Guadalcanal: Sorvorhio basin, *Kajewski* 2702, January 1932, alt. 180 m., rain-forest, common (vine with white flowers); San Cristobal: Huro River, *Brass* 2609 (TYPE), August 1932, lowland rain-forests (scandent; sap milky; leaves coriaceous, pale below; flowers white).

The genus is already known to occur in the Philippines and Polynesia. This species from the Solomon Islands is closely allied to *C. Macgregori* Merr., but the inflorescence of the latter is constantly minutely pubescent and the flower is a little smaller than in the new species.

Wrightia R. Brown

Wrightia laevis Hook. f. Fl. Brit. Ind. **3**: 654. 1882; Markgr. Bot. Jahrb. **61**: 212. 1927.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass* 13893, April 1939, alt. 570 m., rain-forest of mountain slopes (subsidiary tree 12 m. high; flowers white). BRITISH NEW GUINEA: Mt. Tafa, *Brass* 5570, May–September 1933, alt. 100 m., rain-forest on low ridges, common (large tree; trunk corrugated; bark pale brown, slightly flaky; foliage pale green; flowers profuse, pale yellow, perfumed).

Markgraf reported this species from the Bismarck Archipelago, but we have not found any other record of it from Papuasias, although Markgraf determined the above-cited collection from Mt. Tafa.

Parsonsia R. Brown

Parsonsia curvisepala K. Schum. Bot. Jahrb. **9**: 215. 1888; Markgr. Bot. Jahrb. **61**: 219. 1927.

SOLOMON ISLANDS: San Cristobal: Waimamura, *Brass* 2653, August 1932,

lowland rain-forest (one plant seen; large climber; leaves thin, very much paler below, the margins wrinkled; flowers yellow; follicles striate, green; coma on seeds pale brown; sap colorless, slightly viscid).

This specimen differs from those collected in New Guinea chiefly in the larger leaves ($6-8 \times 2.5-4.5$ cm.).

Parsonsia Helicandra Hook. & Arn. Bot. Beechey's Voy. 197. 1836; Merr. Brittonia 1: 236. 1933; Kaneh. & Hatus. Bot. Mag. Tokyo 53: 11. 1939.

Parsonsia spiralis Wall. List no. 1631. 1829, nomen nudum; G. Don, Gen. Syst. 4: 80. 1837; Markgr. Bot. Jahrb. 61: 217. 1927.

SOLOMON ISLANDS: Bougainville: Karngu, Buin, *Kajewski* 2230, October 1930, sea-level, rain-forest, common (vine with green flowers; fruits 19.5 cm. long, 1 cm. diam.); Ysabel: Meringe, *Brass* 3161, November 1932, twining on forest trees, common; San Cristobal: Kira Kira, *Brass* 2771, August 1932, large climber on beach trees, common.

We have not found this widespread species previously recorded from the Solomon Islands.

Parsonsia lata Markgr. Bot. Jahrb. 61: 221. 1927.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass* 13267, March 1939, alt. 850 m., abundant in rain-forest of river plains (large canopy liane; flowers yellow). SOLOMON ISLANDS: Guadalcanal: Berande, *Kajewski* 2434, January 1931, sea-level, common in rain-forest (vine with cream-colored flowers; follicles 12 cm. long, at widest part 3.6 cm. wide, tapering slightly, green, covered with fine brown hairs).

In the Solomon Islands collection the leaves are a little broader in proportion to their length and tend to be less pubescent above than in the material from New Guinea. The species has been collected from Northeastern New Guinea.

Parsonsia mollissima (Wernh.) Markgr. Bot. Jahrb. 61: 220. 1927.

BRITISH NEW GUINEA: Palmer River, 2 miles below junction Black River, *Brass* 7089 (det. Markgraf), June 1936, alt. 100 m., climbing in forest substage (upper leaf surface glossy).

The type was collected in Netherlands New Guinea; the species probably occurs also in Northeastern New Guinea, cf. Markgr. l. c.

Parsonsia flavescens sp. nov.

Frutex scandens; foliis oppositis subcoriaceis lanceolatis vel ovato-ellipticis magnitudine ludentibus, 6-7 cm. longis 1.5-2.3 cm. latis vel 7-9 cm. longis 4.5-5 cm. latis, basi obtusis vel rotundatis, apice acutis vel obtuse acuminatis mucronatis, margine \pm recurvatis, utrinque glabris subtus minute granulatis, nervis lateralibus \pm 9 oblique patentibus utrinque prominulis vel interdum inconspicuis; petiolo 6-9 mm. longo minute pubescente; inflorescentiis axillaribus plurifloris 3-4.5 cm. longis puberulis; pedicello \pm 4 mm. longo; calycis lobis ovatis acutiusculis 2 mm. longis intus pauciglandulosus; corolla flava; tubo 4.5 mm. longo extus glabro intus sub antheris minute piloso, lobis 3 mm. longis 1.5 mm. latis oblongo-lanceolatis; filamentis circiter 2 mm. longis, in medio tubo insertis geniculatis pubescentibus, antheris 4 mm. longis; stigmatibus 1.4 mm. longo obtuse conico in basi annulato; ovario glabro 0.5 mm. longo disco glabro aequilongo cincto.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass*

11573, November 1938, alt. 2350 m., on open face of cliff (small twiner; sap not milky; flowers yellow); Balim River, *Brass* 11647 (TYPE), December 1938, alt. 1600 m., climbing in sparse second growths on deforested slopes (sap not milky; flowers yellow).

Among the New Guinean species this seems to approach *Parsonsia diversifolia* (Warb.) Markgr. most closely; the plant, however, is not hispidulous, the leaves are coriaceous, the flower is twice as large as the dimensions given for Warburg's species, and the disk is entire.

Parsonsia rubra Kaneh. & Hatus. ms.

Scandens; foliis coriaceis glabris lanceolato-oblongis, 6–12 cm. longis 1.5–4.5 cm. latis, basi rotundatis apice acuminatis, nervis lateralibus utrinsecus \pm 6 supra impressis subtus prominulis; petiolo 1.5–2 cm. longo; inflorescentiis terminalibus usque 11 cm. longis; ramulis puberulis; corolla rubra extus glabra.

NETHERLANDS NEW GUINEA: Hollandia, *Brass* 8991, July 1938, alt. 100 m., rain-forest (large canopy liane; flowers red).

We have been able to match this collection only with *Kanehira & Hatusima* 12220 from Netherlands New Guinea. We know that the description of this species was already in manuscript before Pearl Harbor and we anticipate that it is now published, although unavailable to us at present. However, not being able to cite the place of publication, and to protect our use of the name, we have appended a brief Latin description.

ARNOLD ARBORETUM,

HARVARD UNIVERSITY.

NEW AND NOTEWORTHY POLYPETALAE FROM BRITISH GUIANA

N. Y. SANDWITH

THE following descriptions, new combinations, and notes are based on material of Polypetalae collection recently in British Guiana, the specimens, unless otherwise stated, being deposited in the herbarium of the Royal Botanic Gardens, Kew.

DILLENIACEAE

Doliocarpus (Subgen. *Calinea*, Sect. *Eudoliocarpus*) **savannarum** sp. nov.

Ob habitum humilem, folia, flores subsessiles, ovarium dense pilosum valde distincta; a *D. virgato* Sagot e descriptione forsan affini foliorum paginae inferioris indumento debiliter piloso nec tomentoso-puberulo, nervis lateralibus semper paucioribus statim distinguitur.

Frutex humilis, erectus vel procumbens, haud scandens; ramuli subteretes, 3–6 mm. diametro, apicem versus foliiferi ac ibi adpresse pilosi, novelli fere subsericei. *Stipulae* lanceolatae vel lanceolato-oblongae, obtusae, 1 cm. longae, basi ad 5 mm. latae, adpresse pilosae. *Folia* elliptica vel elliptico-oblonga vel oblonga, apice breviter late cuspidato-acuminata, basi cuneata vel maxima obtusa subrotundata, 6–19 cm. longa, 2.5–9.2 cm. lata, valde coriacea, siccitate brunnea vel olivaceo-brunnea, subintegra sed dimidio superiore ob nervos laterales excurrentes distincte denticulata, subtus plus minusve nitidula, supra glabra, subtus secus costam nervosque laterales pilis debilibus satis sparse sed distincte induta ceterum glabra, costa nervisque primariis utroque latere 9–11 sursum arcuatis supra canaliculato-impressis subtus prominentibus, venis subhorizontaliter abeuntibus cum venulis intricate reticulatis omnibus supra vix prominulis sed obviis subtus prominentibus; petiolus adpresse pilosus vel glabrescens, supra canaliculatus subalatus, 1–3 cm. longus, ad 3 mm. crassus. *Flores* in fasciculos plerumque sub foliis dispositi, fere sessiles, pedicellis pubescentibus vix ad 1.5 mm. longis. *Sepala* orbiculari-ovata, apice rotundata, concava, 4.5–5 mm. longa, 3.5–4.2 mm. lata, extra pubescentia, intus glabra. *Petala* obovata, ad 6 mm. longa, ad 3.2 mm. lata. *Stamina* filamentis ad 5 mm. longis apice in connectivum dilatatis; antherarum loculi 0.5 mm. longi. *Ovarium* late ovoideo-subglobosum, dense pilosum; stylus ad 2.5 mm. longus, sparsius pilosus, stigmate peltato. *Fructus* kermesinus, globosus, 8–10 mm. diametro, satis sparse pubescens vel glabrescens, stylo persistente pubescente coronatus.

BRITISH GUIANA: Kaieteur Savannah, c. 400 m., fl. Sept.-Oct. 1881, *Jenman 1038* (TYPE); *ibid.*, fr. Sept. 5, 1937, *Sandwith 1377*. Noted by Jenman as 3–5 ft. high, with erect growth, and by Sandwith as a trailing shrub with crimson berries, growing on sandy bushy ground.

Doliocarpus virgatus Sagot, which was based on imperfect material collected in French Guiana by Perrottet and Mélinon, was described by its author as having *inter alia*: “rami lignosi, validi, recti, virgati. Folia . . . superne glabrescentia, inferne breviter tomentoso-puberula. Nervi lat-

erales, recti, numerosi." The specimens were said to be easily recognizable on account of the peculiar facies. M. Raymond Benoist, in a review of the Dilleniaceae of French Guiana in Bull. Soc. Bot. Fr. IV. 13: 400-401. 1913, slightly amplified the description of *D. virgatus*, to which he referred an additional flowering collection from Pará, remarking that the latter bore fully expanded flowers, whereas the collections from French Guiana were in young fruit, so that it was impossible to be certain whether the stamens were folded back or erect in the bud-stage. On this account he still treated *D. virgatus* as an *espèce à caractères insuffisamment connus*, and did not place it in either Section *Othlis* or Section *Calinea*. The important points to be noted in Benoist's amplified description are the pubescent lower surface of the leaves and the 12-17 pairs of main lateral nerves, characters which sufficiently distinguish *D. virgatus* from the plant of the Kaieteur Savannah.

More recently, mention has been made of *D. virgatus* as an ally, in Section *Eudolioscarpus* of Subgen. *Calinea*, of *D. paraënsis* Sleumer in Rep. Sp. Nov. 39: 45-46. 1935. The latter species evidently differs from *D. savannarum* in the short (6-10 mm.) petiole, the quite glabrous leaves with 7 pairs of main lateral nerves and the reticulation obscure on the lower surface, the glabrous oblong sepals, and the much larger (about 1 cm. \times 6-8 mm.) petals.

FLACOURTIACEAE

Ryania pyrifera (L. C. Rich.) Uitt. & Sleumer var. **subuliflora** var. nov.

A planta typica sepalis angustioribus lineari-lanceolatis plerumque longioribus sursum saepius sensim longe attenuatis 2-4 cm. longis 3-8 mm. latis differt. *Folia* subtus secus costam nervosque primarios stellatopubescentia, ceterum glabrescentia vel glabra.

BRITISH GUIANA: Essequibo River, in wallaba forest, Labbakbra Creek, Tiger Creek, August 26, 1937, *Sandwith 1211* (TYPE); Demerara River, May 1889, *Jenman 4853*; Mazaruni-Kuribrong Divide, in wallaba forest, *Forest Dept. 893*; Bartica-Potaro road, 83rd milepost, in clump wallaba bush, June 1933, *Tutin 216* (Herb. Mus. Brit. and Kew).

A small tree of the lowest storey of the forests of the white sand areas, especially in wallaba forest, up to 20 ft. high, less than 1 inch in diameter; sepals pale greenish white; filaments white, pinkish or red at the base.

This has been written up and distributed as a new species under the name adopted here for the lower rank; the writer is convinced that it does not deserve a higher status on account of the variability in the shape and dimensions of the sepals which can be seen on a really extensive gathering from a single tree. In Trinidad, where typical *R. pyrifera* is plentiful, specimens have been collected (*Fendler 203, Broadway 9358*) on which some of the sepals match some of those on the type collection of var. *subuliflora*.

Ryania pyrifera var. **tomentosa** (Miq.) Sleumer ex Sleumer & Uitt. in Pulle, Fl. Suriname 3: 286. 1935.

This variety, with leaves densely stellate-pubescent or tomentose all over the lower surface, is known in British Guiana from the following collections: Berbice River, *Forest Dept. 774*; Demerara River, *Jenman 3888, Persaud*

174, *Forest Dept.* 774, 2452; Pomeroon District, Tapakooma Creek, *Jenman* 6616. This, from the evidence of field notes, is an undergrowth tree of brown sand areas, while the color of the flower is similar to that of var. *subuliflora*.

Ryania Sagotiana Eichl. in Mart. Fl. Bras. **13**(1): 491. 1871; Sleumer & Uitt. in Pulle, Fl. Suriname **3**: 287. 1935.

This species, which has strongly prominulous ultimate veinlets on the lower surface of the leaves and, above all, a conspicuously raised disk and a long stipe to the ovary, has been twice collected in British Guiana: Buruma Creek, Kibilibiri Creek, Berbice River, 1919, *Forest Dept.* 774A; Upper Demerara River, Sept. 1887, *Jenman* 4098. This, again, is a shrub or small tree.

GUTTIFERAE

Caraipa simplicior sp. nov.

Inter species foliis inflorescentisque pubescentibus praeditas ob inflorescentias axillares atque terminales valde abbreviatas reductas, scilicet cymas plerumque 1-3-floras gerentes, praeterea ob sepala magna singularis, *C. grandifoliae* Mart. forsan affinis sed forma inflorescentiae praeterea foliisque minoribus distinguitur.

Arbor satis grandis, 27 m. alta; ramuli angulati superne furfuraceo-tomentelli. *Folia* lanceolata vel anguste elliptico-oblonga, apice acuta, obtusa vel brevissime cuspidata, basi cuneata sed saepe obtusa vel fere rotundata tum abrupte in petiolum decurrentia, 3.5-11 cm. longa, 1.3-4.3 cm. lata, illa inflorescentias subtendentia sensim reducta, coriacea, marginibus revolutis ac apice saepe recurvato fissoque, supra subopaca minute haud dense sed regulariter stellato-puberula, subtus plus minusve incana indumento lepidiformi arcte minute stellato-tomentella, costa nervisque supra canaliculato-impressis subtus (costa valde) prominentibus, nervis primariis utroque costae latere 16-20 patulo-adscendentibus subrectis sed marginem versus sursum arcuatis, nervis secundariis crebris supra impressis haud obviis subtus manifestis sed inconspicuis; petiolus 4-10 mm. longus. *Inflorescentiae* e cymis axillaribus atque terminalibus plerumque simplicibus 1-3-floris rarius compositis 4-floris brevipedunculatis ad 2.5 cm. longis ubique praesertim sepalis ferrugineo-stellato-tomentellis constantes; bracteae conspicuae, ovatae vel ovato-oblongae, 5-10 mm. longae, ad 3.5 mm. latae, nonnunquam majores foliaceae; bracteolae similes sed paulo minores; pedicelli 3-5 mm. longi rigidi. *Sepala* basi tantum connata, late ovata, apice obtusa, basi rotundata, 5.5-6 mm. longa, 5 mm. lata, nonnunquam extra plus minusve carinata, utrinque stellato-tomentella. *Petala* obovata, unilateraliter in appendicem latam membranaceam producta, hac inclusa 1.4-1.5 cm. longa, 0.6-0.8 cm. lata, partibus crassioribus utrinque dense stellato-puberulis partibus membranaceis glabris ciliatis. *Stamina* longiora ad 7 mm. longa; antherae forma generis propria obovato-rhomboidea, circiter 0.75 mm. longae atque latae. *Ovarium* pluricostatum, 2.75 mm. diametro, stellato-tomentellum; stylus glaber, 3.5 mm. longus, clavatus, apicem versus sensim incrassatus. *Fructus* non visus.

BRITISH GUIANA-VENEZUELA BOUNDARY REGION: Roraima, slopes near Arabupu, in swampy soil in mixed forest, 1380 m., Dec. 15, 1938, *Forest Dept.* 2823 (field no. *P. 51*) (TYPE); tree 90 ft. high, 12 in. diam., with scaly bark like that of Sawarri (*Caryocar nuciferum*); fls. white, cup-shaped; calyx green; petals buff; stamens white.

This species somewhat resembles *C. minor* Huber and *C. parvifolia* Aubl. in its leaves. *Caraipa minor*, however, has the leaves densely pilosulous beneath with simple hairs, while its sepals are connate for at least half their length. *Caraipa parvifolia* Aubl., the type of which consists of leaves and branchlets alone, has relatively shorter petioles and, if other French Guiana sheets are correctly identified with it, a terminal compound inflorescence with small sepals (see Jour. Bot. **80**: 53. 1942).

MALPIGHIACEAE

Byrsonima incarnata sp. nov.; Subgen. *Macrozeugma*, Sect. *Colobotheca*, Subsect. *Atrichotheca*, seriei *Stenolepis*, ex clavi cl. Niedenzu in Engler, Pflanzenreich 94 (IV. **141**). 1928.

Ut videtur juxta *B. persicifoliam* Griseb. atque *B. frondosam* Mart. ex Juss. ponenda, ab utraque ovario tomentoso, praeterea ab illa antherae connectivi appendicula loculos longe superante, ab hac foliis majoribus senectute tantum fere glabris statim distinguitur; revera, ut videtur, *B. Schomburgkianae* Benth. magis affinis, a qua petiolis longioribus, bracteolis ovatis, antherae loculis glabris, ovario tomentoso distinguitur.

Arbor parva vix mediocris, circiter 13 m. alta, ramulis summis teretibus hornotinis dense adpresse ferrugineo-pilosis. *Stipulae* ovatae, obtusae, 4.5–6.5 mm. longae, extra indumento ramulorum indutae. *Folia* obovata, obovato-elliptica vel elliptica, apice rotundata brevissime cuspidata vel in exemplis maximis ellipticis magis attenuata ac acuminata, basi in petiolum attenuata cuneata, 11–26 cm. longa, 5.4–10.5 cm. lata, satis tenuiter coriacea, supra siccitate brunneo-nigrescentia nitidula subtus pallidiora, supra sparse cinereo-pubescentia vel plus minusve glabra subtus juventute satis copiose pubescentia demum fere glabra, costa nervisque primariis supra prominulis subtus prominentibus, nervis primariis utroque costae latere 12–18 patulis vel patulo-ascendentibus et satis longe a margine anastomosantibus, nervis secundariis supra inconspicuis vel impressis subtus venuliscum planis vel tenuiter prominulis satis conspicuis; petiolus indumento ramulorum praeditus, demum glabrescens, 1–2.5 cm. longus. *Racemi* 10–18 cm. longi; rhachis angulata, satis dense subadpresse pallide ferrugineo-pilosa, nisi basim versus densiflora; bractae anguste lanceolato-oblongae, obtusae, 5–7 mm. longae, basi ad 2 mm. latae, patulae vel patentes et sursum incurvatae, demum deciduae, extra praesertim secus medium fere subsericeo-pubescentes; bracteolae dimidio breviores, ovatae, obtusae, extra pubescentes; pedicelli villosulo-ferrugineo-tomentosi, 5–9 mm. longi. *Alabastra* carnea. *Sepala* glandulas roseo-carneas 2.5–3 mm. longas siccitate albo-flavescentes gerentia; lamina deltoideo-ovata, obtusa, 2.5–3.5 mm. longa, 2.5 mm. lata, utrinque pubescenti-tomentosa. *Petala* alba roseo-suffusa, vel pallide rosea, ungue 3–3.5 mm. longo, lamina orbiculari-cordata vel (in petalis minoribus) reniformi-orbiculari, 5.5–8 mm. longa, 6.5–8 mm. lata. *Torus* pilosus. *Stamina* glabra, filamentis brevissimis antherae subaequilatis circiter 0.5 mm. longis; antherae connectivo incluso 2–2.6 mm. longae, loculis brevibus obscuris circiter 1 mm. longis lineari-oblongis glabris apice obtusis rotundatis neque mucronatis nec aristatis, connectivi appendicula valde evoluta crassa oblonga vel conoidea obtusa glabra usque ad 1 mm. lata loculos longe plus quam duplo superante. *Ovarium* ovoideum, dense tomentosum, 2 mm. longum, 1.75 mm. diametro; styli glabri, fere 2 mm. longi. *Fructus* non visus.

BRITISH GUIANA: Moraballi Creek, Essequibo River, in greenheart forest on brown loam, Oct. 13, 1938, *Fanshawe in Forest Dept.* 2737 (TYPE); Bartica-Potaro road, near 14th milepost, in wallaba forest on white sand, Aug. 19, 1937, *Sandwith* 1145. Each of the trees from which these collections were made was about 50 ft. high and 4 inches in diameter. The calyx is pale olive or brown, with waxy vermilion glands, while the petals are pale pink or white with a tinge of pink.

The fact that this tree is almost certainly an ally of *B. Schomburgkiana*, a savannah species with hairy anther-loculi in Niedenzu's Subsect. *Dasytheca* of the Subgenus *Macrozeugma*, shows that this author's choice of characters in the anthers for constituting major divisions of his key results in an artificial arrangement which separates species naturally allied.

The addition of this species and of *B. Poeppigiana* Juss. (see Kew Bull. 1937: 102. 1937, and Lloydia 2: 188. 1939) brings the number of species of *Byrsonima* known to occur in the Colony up to fourteen. The key offered by the writer in Kew Bull. 1935: 314-315. 1935 must now be emended for the inclusion of these two species, as follows:

Anther loculi not horned:

Mature leaves glabrous or nearly so; petals white to deep rose:

Leaves subsessile, rounded and more or less cordate at the base, obtuse, rounded or emarginate at the apex. *B. coccolobifolia*.

Leaves distinctly petiolate, attenuate and cuneate at the base:

Leaves commonly or always exceeding 9 cm. in length; bracts linear to narrowly oblong-lanceolate:

Petioles less than 1 cm. long; bracteoles linear-oblong; anther loculi pilosulous. *B. Schomburgkiana*.

Petioles 1 cm. or more long; bracteoles ovate; anther loculi glabrous. *B. incarnata*.

Leaves usually less than 9 cm. long; bracts ovate or ovate-lanceolate. *B. eugenifolia*, *concinna* and *bracteolaris*.

Mature leaves not glabrous or, if nearly so, then petals yellow; petals bright yellow except in *B. chalcophylla*:

Bracts conspicuously curled backwards:

Leaves reddish rusty-tomentose beneath; petioles commonly more than 1.5 cm. long. *B. Aerugo*.

Leaves sparsely pubescent or glabrescent beneath; petioles rarely up to 1.5 cm. long. *B. Poeppigiana*.

Bracts not conspicuously curled backwards. *Species as in the previous key*.

Byrsonima Poeppigiana is a species of Amazonian Brazil and Peru which has recently been found as a small river-bank tree in the far interior of British Guiana, towards the Brazilian frontier.

Kostermans, in Pulle, Fl. Suriname 2: 243. 1936, and in his notes on the new and critical species of Surinam Malpighiaceae (in Meded. Bot. Mus. en Herb. Utrecht 25: 10-12. 1936), reduces Bentham's *B. rugosa* to *B. stipulacea* Juss., of which he regards it as merely a form with gland-bearing sepals.

Banisteriopsis elegans (Tr. & Pl.) comb. nov.

Banisteria elegans Tr. & Pl. in Ann. Sci. Nat. IV. 18: 322. 1862; Nied. in Engler, Pflanzenreich 93 (IV. 141): 412. 1928.

Banisteriopsis elegans subsp. *cordata* (Nied.) comb. nov.

Banisteria elegans subsp. *cordata* Nied. in Verz. Vorles. Ak. Braunsberg W.-S. 1912-1913: 10. 1912, in Engler, Pflanzenreich 93 (IV. 141): 413. 1928.

Banisteriopsis elegans subsp. **cordata** var. **ciliata** (Nied.) comb. nov.

Banisteria elegans subsp. *cordata* var. *ciliata* Nied. in Verz. Vorles. Ak. Braunsberg W.-S. 1912-1913: 10. 1912, in Engler, Pflanzenreich 93 (IV. 141): 413. 1928.

Banisteriopsis elegans subsp. **cordata** var. **pulcherrima** var. nov.

Var. *ciliatae* (Nied.) Sandwith affinis foliis magis coriaceis basi profundius eximie auriculato-cordatis, bracteis inflorescentiae irregulariter longius fimbriatis apice nonnunquam pectinatis fimbriis nonnullis ad 4 mm. longis, floribus speciosioribus differt.

BRITISH GUIANA: Kaieteur Savannah, c. 400 m., fl. and fr. Sept. 8, 1937, *Sandwith 1430* (TYPUS); *ibid.*, Sept.-Oct. 1881, *Jenman 1256*; *ibid.*, Aug. 1933, *Tutin 694* (Herb. Mus. Brit. and Kew); *ibid.*, Feb. 20, 1939, *Sir Geoffrey Evans 12*; Membaro Creek, Mazaruni River, Feb. 14, 1939, *Forest Dept. 2845* (field no. *P. 73*); Roraima, "Our House," Dec. 10, 1884, *im Thurn 136*, Sets A and C.

This is one of the most beautiful of all the remarkable plants found on the hard sandstone conglomerate of the Kaieteur Savannah. It is a shrub trailing over bushes and small trees to a length of some 12 feet. The flowers are borne in showy lax sprays and simulate those of a species of *Oncidium*. They are at least 2.5 cm. across, conspicuously zygomorphic, with bright yellow fringed petals, the anterior one striped with crimson veins in the lower half, and white stigmas. The peculiar long cilia of the bracts of the inflorescence are crimson. The fruiting thyrse is scarcely less attractive than the flowering sprays, since the large wings of the samaras are pink.

It is by no means certain that this beautiful plant, with its very definite range which is shared by so many others, does not deserve a higher rank than is proposed for it; but this could not satisfactorily be accorded without a thorough review of Niedenzu's treatment of the aggregate species *B. elegans*, and insufficient material has so far been accumulated for this purpose from other parts of the range. Moreover, there is the further question of the relationship of *B. elegans* with *B. leptocarpa* (Benth.) R. O. Williams, to which Kostermans has recently reduced its subsp. *cordata* var. *ciliata* (see his notes on new and critical species of Surinam Malpighiaceae, in Meded. Bot. Mus. en Herb. Utrecht 25: 8. 1936). If this reduction be correct, then the case for raising this new var. *pulcherrima* to specific rank becomes stronger, since *B. leptocarpa*, which is a very common species in British Guiana and occurs with var. *pulcherrima* on the Kaieteur Savannah, is remarkably distinct from it in the field, having a much denser more complex inflorescence, with smaller flowers and rather pale yellow petals. But the writer is by no means convinced that the type collection of *B. elegans* subsp. *cordata* var. *ciliata*, viz. *H. H. Smith 1509* from Santa Marta, Colombia, should be so summarily reduced to *B. leptocarpa*, since it does not show this characteristic inflorescence.

RUTACEAE

Rhabdodendron amazonicum (Benth.) Huber in Bol. Mus. Goeldi 5: 427. 1909; Ducke in Arch. Jard. Bot. Rio 3: 181. 1922.

In the opinion of the writer, *Lecostemon sylvestre* Gleason (in Bull. Torrey Club 54: 608. 1927) cannot be separated from *Rhabdodendron*

amazonicum, a frequent small tree of campos and campinas in Amazonian Brazil. The variability of that species was discussed by Ducke in 1922 and is apparent in several British Guiana collections, especially in the size, the texture, and the prominence of the venation of the leaves, the angle taken by their lateral nerves, the degree of pubescence on the inflorescence, and the length of the pedicels. In British Guiana this species occurs as a small to medium-sized tree, on white or dark brown sand. The following collections are in the Kew Herbarium.

BRITISH GUIANA: Hill slope on brown sand, Warunana Creek, Ituni River, Berbice River, *Forest Dept.* 450; slope on white sand, Kuruabaru River, Demerara River, *Forest Dept.* 450A; in wallaba forest, Moraballi Creek, Essequibo River, *Forest Dept.* 2747; common in "clump wallaba" (*Dicymbe corymbosa*) bush, 83 miles along Bartica-Potaro road, *Tutin* 243 (Herb. Mus. Brit. and Kew); in forest on white sand between Kangaruma and Garraway Stream, Potaro River, *Sandwith* 1237; in dense forest between Kangaruma and Potaro Landing, *Gleason* 211 (type coll. of *Lecostemon sylvestre*). *Forest Dept.* 2747 (Moraballi Creek) was taken from a tree 60 ft. high and 12 inches in diameter; the other collections were all from small trees of the undergrowth.

The genus *Rhabdodendron* Gilg & Pilger and the question of its identity with *Lecostemon* DC. were fully discussed by Huber in Bol. Mus. Goeldi 5: 424-431. 1909, where a new tribe in Rutaceae was proposed for *Rhabdodendron*.

***Rhabdodendron Gardnerianum* (Benth.) comb. nov.**

Lecostemon Gardnerianum Benth. in Hook. Jour. Bot. & Kew Misc. 5: 295. 1853;

Hook. f. in Mart. Fl. Bras. 14(2): 54. 1867; Huber in Bol. Mus. Goeldi 5: 427. 1909.

BRAZIL: Bahia: Banks of the Rio Preto, Sept. 1839, *Gardner* 2814, "a small tree 12-16 feet high." This locality lies in the northwestern corner of the modern State of Bahia; it was incorrectly placed by Benthham in the State of Piauhhy, while in Gardner's day it apparently lay within the southwestern limits of that of Pernambuco (see Gardner's "Travels," ed. 1. 298, 309, and map).

Evidently a member of this genus, and strikingly distinct on account of the small leaves, but not included in the conspectus of *Rhabdodendron* given by Huber, and not mentioned by Engler in the latest treatment of Rutaceae in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 19A: 358. 1931, where Huber's tribe Rhabdodendreae is accepted.

OCHNACEAE

***Ouratea cataractarum* sp. nov.**

Inter congeneros forma foliorum inflorescentiaeque, pedicellis longis rectis valde distincta.

Frutex vel arbor parva, glabra, ramulis summis tenuibus 1.5-3 mm. diametro, internodiis brevibus. *Stipulae* lanceolatae, 3-5.5 mm. longae, longitudinaliter striatae. *Folia* anguste salicifolia, lineari-elliptica vel lineari-lanceolata vel anguste oblanceolata, in apicem acutum longe attenuata, nonnunquam acuminata, basi in petiolum longe acute attenuata atque decurrentia, 4.5-12.5 cm. longa, 0.7-2.2 cm. lata, basin versus integra superne tenuiter satis obscure (apicem versus conspicuius) obtuse serrulata, marginibus cartilagineis subrevolutis, coriacea, supra nitida, siccitate olivacea vel subtus brunnea, costa supra prominula subtus prominente, nervis venisque utrinque subaequaliter prominulis, nervis primariis utroque costae latere 6-8 primo sursum arcuatis tum praerupte ascendentibus et in mar-

ginem demum provectis, venulis subhorizontalibus crebris obviis; petiolus 4–8 mm. longus. *Inflorescentia* terminalis, erecta, paniculata, pyramidalis, 4–8 cm. longa, ad 10 cm. lata, ramis satis paucifloris patulis vel patulo-ascendentibus rectis angulatis inferioribus ad 4.5 cm. longis; bractee bracteolaeque deciduae, haud visae; pedicelli ascendentes, recti, graciles, 1.2–1.9 cm. longi, superiores apice ramorum corymbos praebentes. *Alabastra* ovoideo-oblonga, obtusa, 6–7.5 mm. longa, ad 3.75 mm. diametro. *Sepala* flava, oblongo-lanceolata, obtusa, apice cucullata, 7–8 mm. longa, 2.5–3 mm. lata, concava, subcoriacea, longitudinaliter tenuiter striata, interiora marginibus late membranaceo-scariosis. *Petala* laete flava, obovato-spathulata, unguiculata, 8–9 mm. longa, 5.3–6.5 mm. lata. *Antherae* 6.3–7 mm. longae. *Torus* sub anthesi 0.8 mm. longus, sub carpidiis maturis turbinato-subglobofus 4 mm. longus 4.5 mm. latus. *Carpidia* 5, sub anthesi 0.8 mm. longa, matura (drupae) ellipsoidea vel obovoideo-ellipsoidea 8–8.5 mm. longa ad 5.5 mm. diametro.

BRITISH GUIANA: Potaro River, Amatuk portage, on rocks by the fall, fl. Aug. 31, 1937, *Sandwith* 1244 (TYPUS); Kaieteur Savannah, fl. et fr. Sept.-Oct. 1881, *Jenman* 890, 1213 (fr.), 1264. A shrub or small tree, with bright yellow sepals and petals.

This is a very pretty small tree, presumably to be classed as one of Dr. Van Steenis' "rheophytes" on account of the willow-like leaves and the habitat — see Bull. Jard. Bot. Buitenzorg III. 12: 174–175. 1932. The same morphological adaptation is seen in the beautiful *Hirtella angustissima* Sandwith, which grows in the same locality at Amatuk and in many other spots along the banks of the Potaro.

***Ouratea cernuiflora* sp. nov.**

Ob racemos axillares, flores nutantes cernuos, calycem omnino integrum coriaceum sub anthesi tantum ad basin in lobos 2–3 concavos fissum, scilicet sepalis omnino secum concretis nec etiamnunc alabastro singillatim distinguendis imbricatis postea sejunctis, peregregia, *O. vaccinioidi* (St. Hil. & Tul.) Engl. forsan affinis.

Frutex vel arbor parva, glabra, ramulis rigidis 2.5–5 mm. diametro densifoliatis internodiis brevibus. *Stipulae* lanceolatae, 10–11 mm. longae, longitudinaliter striatae. *Folia* elliptica vel obovato-elliptica, apice obtusa nonnunquam rotundata, summo apice ipso semper plus minusve levissime emarginato necnon decurvo pagina superiore concavo, basi attenuata cuneata ac in petiolum decurrentia, 2.5–10.5 cm. longa, 1–5 cm. lata, integra vel sub lente dimidio superiore obsolete remote undulato-serrulata, marginibus cartilagineis, utrinque plus minusve nitida, siccitate brunneo-olivacea, costa supra secus sulcum paginae tenuiter saepe acute prominula subtus prominente inferne lata obtusa superne angustata acutata, nervis venulisque supra immersis oculo vix vel haud distinguendis subtus nunc prominulis nunc primariis exceptis obscuris atque plus minusve immersis, primariis utroque costae latere circiter 8–10 primo arcuatis tum sursum (inferioribus longe, superioribus gradatim brevius) marginem versus prae-rupte ascendentibus, intermediis e costa exorientibus numerosis, venulis creberrimis subhorizontalibus parallelisque; petiolus supra canaliculatus, 2–10 mm. longus. *Inflorescentia* e racemis simplicibus ex axillis foliorum plane evolutorum exorientibus praeterea e panicula terminali racemiformi basi tantum breviter ramosa constans, axibus angulatis compressis ascendentibus; racemi 3–7.5 cm. longi, superne satis densiflori; bractee bracteo-

laeque ovatae vel ovato-oblongae, obtusae, nonnunquam emarginatae, 1.5–3.75 mm. longae, ad 2 mm. latae, longitudinaliter striatae; pedicelli recurvi, 3–9 mm. longi. *Flores* cernui, nutantes, siccitate (etiam in vivo ?) saepe secundi. *Alabastra* ovoidea, apice breviter acuminata vel obtusata, ad 6.5 mm. longa, ad 5 mm. diametro. *Calyx* egregius, omnino coriaceus, integer, sepalis secum omnino concretis haud singillatim distinguendis nec ut in ceteris speciebus visis distinctis atque marginibus scariosis imbricatis, sub anthesi ad basin in lobos 2 vel 3 valde concavos ovatos vel semicirculares obtusos rotundatos vel subacutos atque plus minusve apiculatos 6–7.5 mm. longos 5.5–8 mm. latos longitudinaliter striatos marginibus incrassatis fissus. *Petala* obovato-spathulata, elliptico-oblonga vel oblonga, apice acute erosa biloba, in basin latam attenuata, 7–10 mm. longa, 3.3–5.75 mm. lata. *Antherae* 4.3–6 mm. longae. *Torus* sub anthesi 0.8 mm. longus, sub carpidiis maturis turbinato-pulvinatus 2–4 mm. longus circiter 3.5 mm. latus. *Carpidia* 5, sub anthesi 0.8 mm. longa, matura obovoideo-subglobosa 5–7 mm. longa 4–5.5 mm. diametro.

BRITISH GUIANA: Kaieteur Savannah, Potaro River, fl. Sept.-Oct. 1881, *Jenman* 863, 1042 (TYPUS), 1210, "a spreading shrub or small tree, about 10 ft. high;" François Creek, Mahaicony River, Demerara Co., fr. March 1934, *Davis* in *Forest Dept.* 2367, "shrub 6–10 ft. high, abundant in scrub savannah, soil swampy with peaty humus overlying white sand. Peduncle, calyx and fruit deep red; seeds dark glossy greyish-green or pale yellow."

An outstanding species of *Ouratea* on account of the ascending axillary racemes with nodding flowers on recurved pedicels and the very peculiar calyx with completely fused and indistinguishable sepals, ruptured at the time of flowering into 2 or 3 concave coriaceous lobes. A tendency to a gradation towards this phenomenon can be observed in certain other species, for instance, on some specimens of *O. acuminata* (DC.) Engl., in which the inner sepals adhere so closely to the coriaceous outer members that their broadly scarious free margins cannot be separated and distinguished without dissection and examination of the inner side of the whole calyx.

A possible ally of this plant is *O. vaccinioides* (St. Hil. & Tul.) Engl., of the States of Bahia, Minas Geraes, and Rio de Janeiro, in Central Brazil; it has somewhat similar but uniformly small leaves, terminal panicles of nodding more or less secund flowers, and distinct sepals.

This is the second instance of a rare undescribed plant growing both on the British Guiana peneplain, on the low-lying scrub savannah of the Mahaicony River, and on the Kaieteur Savannah at the edge of the Pakaraima escarpment; the previous example was the malpighiaceae *Byrsonima eugenifolia* Sandwith.

Several other undescribed *Ourateae* from British Guiana are represented in the Kew Herbarium, but they are more critical than the two very distinct species described above, and a review of the members of the genus occurring in the Colony cannot be prepared without the examination of specimens and literature which are at present unavailable. The number of species of *Ouratea* found in British Guiana is probably not less than twenty.

NOTEWORTHY SPECIES FROM MEXICO AND ADJACENT UNITED STATES, I

IVAN M. JOHNSTON

SINCE, in continuation of studies of the flora of northern Mexico, many noteworthy species from the adjacent parts of the United States will be discussed, it seems advisable to begin a new series under the above more inclusive title to replace my "New Phanerogams from Mexico," of which no. V was published in this Journal, **24**: 90-98. 1943. Unless otherwise noted, the material cited in this series is deposited in the Gray Herbarium or in the herbarium of the Arnold Arboretum.

Atriplex prosopidum, sp. nov.

Frutex monoicus rotundus pallidus 5-12 dm. altus ramosissimus; ramulis gracilibus foliosis ascendentibus numerosis teretibus pallidis vesiculosus; foliis integerrimis numerosis alternis oblanceolatis ad late oblanceolatis vel oblongo-obovatis, 4-plo ad subduplo longioribus quam latis, 15-20(-24) mm. longis, 3-6(-7) mm. latis, supra medium vel medium versus latioribus, deinde basim versus in petiolum 1-2 mm. longum gradatim attenuatis, costatis sed enervatis, indumento pallido vesiculoso tectis, apice obtusis vel subretusis; floribus masculis flavis in panicula conspicua terminali subnuda moniliforma dispositis; floribus femineis abundantibus glomeratis in spica plus minusve interrupta infra medium foliato-bracteata dispositis; bracteis fructiferis 4-alatis dense furfuraceis summum ad apicem connatis, corpore (alis 1-3 mm. latis exclusis) 1-2 mm. longe stipitato 3-5 mm. longo infra medium crassiore apice in rostrum 1-1.5 mm. longum angustum vel triangularem protracto, corpore alato a latere viso triangulari vel triangulari-ovato, 2.5-6 mm. lato, supra medium saepe latiore, basi rotundo vel obtuso, margine alis prominenter paucidentatis; seminibus brunneis ad 2 mm. longis, radícula lateraliter erecta.

COAHUILA: About 10 miles north of Cuatro Ciénegas, Wynd 742 and 744; south of El Oso, rounded bush 2-3 ft. tall, Johnston 8877 (TYPE, Gray Herb.); near Flores, plant bushy, somewhat globose, 1-4 ft. tall, Johnston 8875; 12 miles north of Monclova, bush 3-4 ft. tall, Johnston 7187.

This species appears to be a relative of *A. canescens*, but differs in selection of habitat, indument, form of growth, color of herbage, shape of leaves, and size and shape of fruit. The fruit has four wings as in *A. canescens*, but it is smaller, distinctly more furfuraceous, and short-stipitate. About Flores and El Oso, on the road from Cuatro Ciénegas north to Ocampo (in the area where Wynd also collected the plant), I was able to compare living specimens of *A. prosopidum* and *A. canescens*. The former is a pallid rounded somewhat globose bush growing with *Suaeda*. *Atriplex canescens* did not associate with the *Suaeda* and differed conspicuously from *A. prosopidum* in being taller, stricter in branching and erect, and a light ashy

green rather than pallid. The indument of *A. prosopidum* is similar to that of *A. obovate* and *A. Nuttallii*, and hence very much denser and much paler than in *A. canescens*. North of Cuatro Ciénegas and north of Monclova the plant grows abundantly in silty, somewhat gypseous and saline valley soils supporting a luxuriant growth of *Prosopis glandulosa*. About Flores and El Oso *A. canescens* was rare in the areas where *A. prosopidum* abounded, perhaps because of the gypseous content of the soil.

Suaeda jacoensis, sp. nov.

Planta succulenta annua vel perennis 1–3 dm. alta glabra pallide viridis, basi ramosa; caulibus gracilibus numerosis erectis strictis simplicibus vel sparse ramosis plus minusve minute verrucosis non raro rosaceis; foliis linearibus 1–2 cm. longis 1.2 mm. latis compressis succulentis, apice obtusis apiculatis, inferioribus conspicue oppositis, ceterum alternis; floribus axillaribus sessilibus glomeratis subspicatis; bracteis hyalinis triangularibus vel oblongis dentatis vel lacerato-dentatis haud conspicuis; calyce fructifero latiore quam lato (sine appendiculis 1–1.5 mm. diametro) depresso asymmetrico, lobis deltoideis margine scariosis dorso irregulariter tuberculato-cristatis vel carinatis, basi non raro transverse alatis vel gibbosis; seminibus horizontalibus 1.1–1.3 mm. longis nitidis atro-brunneis; stylis 2.

COAHUILA: Salt-flats at the southeastern end of Laguna de Jaco, common, Johnston & Muller 1087, Stewart & Johnston 1975 (TYPE, Gray Herb.) and 1976.

Related to *Suaeda mexicana*, from which it differs in its lower stature, more slender and smaller leaves (which are conspicuously opposite below), more slender somewhat purplish usually verrucose stems, and irregularly cristate and keeled mature calyx-lobes. The perianth-lobes become unequally cristate and carinate at maturity, some being almost unappendaged, others corky-tuberculate, while others may have a vertical as well as a transverse basal keel that may become corky-thickened. In *S. mexicana* all the perianth-lobes become corky-thickened and prolonged off obliquely at their base. The proposed species may appear as a perennial, with the stems arising from a small caudex crowning a coarse persisting root. Most of the plants seen, however, appear to be annual. The species is very common on the flats at the southeastern end of Lake Jaco. The soil here is strongly saline and also gypsiferous.

Suaeda nigrescens, sp. nov.

Frutex 3–6 dm. altus ascender ramosus erectus vel decumbens in sicco saepe nigrescens; ramulis gracilibus rigidulis fruticosis ramulosis angulatis, pilis minutis brunnescentibus saepe abundantibus donatis, in vivo saepe purpurascens; foliis succulentis plus minusve glaucis glabris 3–5 (–8) mm. longis 1 (–2) mm. latis, plus minusve compressis lineari-oblongis vel oblanceolatis numerosis confertis, medium versus latioribus, apice obtusis vel rotundis, basi angustatis; floribus glomeratis basim versus foliorum superiorum vix conspicuorum enatis homomorphis subspicatis; bracteis scariosis triangularibus vel ovato-triangularibus sparse dentatis inconspicuis haud persistentibus; calyce fructifero glabro turbinato 1.5–2 mm. diametro, lobis deltoideis convexis succulentis; stylis 2 vel 3; seminibus nigris nitidis oblique ovoideis crassis erectis vel horizontalibus ca. 1 mm. longis.

COAHUILA: 4 mi. southwest of Hermanas, saline flat, *Johnston* 7074; 8 mi. north of Avalos, saline flat, *Johnston* 7340; 12 mi. north of La Ventura, saline flat, *Johnston* 7650 (TYPE, Gray Herb.). SAN LUIS POTOSI: 6 mi. northwest of Cedral, saline flat, *Johnston* 7603; San Miguel, saline flat, *Johnston* 7619; San Domingo Lake, *Lundell* 5576; Hacienda del Salado, Dec. 1827, *Berlandier* 1345; San Luis Potosi to Tampico, *Palmer* 778½.

Suaeda nigrescens, var. *glabra*, var. nov.

A varietate typica differt ramulis omnino glabris saepe glaucis, raro ramulis junioribus pilis sparsissimis pallidulis donatis.

CHIHUAHUA: Meoqui, 1935, *LeSueur* 197. COAHUILA: about 30 mi. south of Sierra Mojada, 1937, *Wynd* 771. TEXAS: along irrigation ditch, Rio Grande Valley, near old Fort Quitman, *Waterfall* 3993a (TYPE, Gray Herb.); saline plains of Rio Grande [near Eagle Pass], 1848, *Wright*; salt flats near Pilgrim, Gonzales Co., *Cory* 18992 and 19213. NEW MEXICO: White Sands, Otero Co., *Archer* 7334; Hagerman, Chaves Co., *Benke* 5023.

The present plant is that treated by Standley, in No. Am. Fl. **21**: 90 (1916) and in Bull. Torr. Cl. **44**: 428 (1917), as indistinguishable from the Old World *Suaeda fruticosa* (L.) Forsk. That species was based on plants from the Mediterranean coast of France and Spain. It differs from our present plant in aspect, as well as in the more slender and elongate styles and less persistent more scarious bracteoles. Our species behaves as a native plant and I am convinced that it is indigenous. It is related to *S. fruticosa*, but so are such generally recognized West American species as *S. Torreyana* Wats., *S. Palmeri* Standl., *S. ramosissima* (Standl.) Johnston, etc. In fact, our plant is as closely related to these American congeners as it is to the Old World plant. Unless most of the American members of *Suaeda* Section *Salsina* are to be submerged in *S. fruticosa*, the present species must also be accorded recognition.

I can find no available published names for the present plant. *Suaeda fruticosa* var. *multiflora* Torr. (1857) is based upon a collection by Bigelow, from "Llano Estacado," or, to be more precise, from the region about Tucumcari, New Mexico. This plant may represent *S. nigrescens* var. *glabra*, but because of *Suaeda multiflora* Phil., a Chilean species, the name is unavailable for our North American plant. *Suaeda Moquini* (Torr.) Greene, based upon the casually published *Chenopodina Moquini* Torr. (1858), is properly discarded as a hyponym by Standley, in Bull. Torr. Cl. **44**: 428 (1917). Standley, in No. Am. Fl. **21**: 90 (1916), cites *S. intermedia* Wats. (1879) as a synonym of *S. fruticosa*. That species, based upon cited material from Utah, collected by Ward, Parry, Hooker and Gray, is not *S. nigrescens*. Since *Parry* 84, from "Central Utah," is the only cited collection of *S. intermedia* with good flowers and is the only one on whose sheet Watson wrote his binomial, I am taking that plant as the type of *S. intermedia* Wats. This type and the other cotypes all appear to represent the common Utah plant which most recent authors, including Standley, have called *S. Torreyana* Wats. Though it seems probable that Watson proposed *S. Torreyana* to include American plants formerly placed in *S. fruticosa*, usage has centered his binomial on Great Basin plants, and Standley has typified it with the material collected on the west shore of the

Great Salt Lake by Stanbury. *Suaeda diffusa* Wats. was based upon eleven collections, of which the two collections of Charles Wright represent *S. nigrescens*, and of which *Gregg 458* represents *S. suffrutescens* var. *detonsa*. Seven of the original eleven collections came from Utah and Arizona and appear to represent the plant commonly called *S. Torreyana*. In describing *S. diffusa*, Watson drew heavily on his collection no. 996 and his account of it in the Botany of the King Expedition, p. 294. That specimen is logically the type of his *S. diffusa*. It was collected in Truckee Valley and is conspecific with *Heller 8650*, also from that area, and obviously belongs to the aggregate called "*S. Torreyana*." Standley cites *Dondia conferta* Small as a synonym of *S. fruticosa*. That species, based on plants collected on the coastal flats at Corpus Christi, Texas, differs from *S. nigrescens* in its spreading less fruticose habit, large flowers, and conspicuous leafy bracts. It is the sea-coast plant found on the coast of Texas and eastern Mexico and in the West Indies. It should be called:

Suaeda conferta (Small), comb. nov.

Dondia conferta Small, in Bull. N. Y. Bot. Gard. 1: 280. 1899.

***Suaeda suffrutescens* Wats., var. *detonsa*, var. nov.**

A varietate genuina differt foliis glabris, caulibus non raro glabrescentibus.

COAHUILA: 3 mi. west of Cuatro Cienegas, saline flats, loosely and widely branched, 1–5 ft. tall, frequently supported by other bushes, *Johnston 7128* (TYPE, Gray Herb.); 3 mi. south of Cuatro Cienegas, saline land, low shrub, *White 1913*; Cuatro Cienegas, *Marsh 2042*; Perros Bravos, shrubby, 3 ft. tall, abundant, Sept. 20, 1848, *Gregg 458*; Saltillo, July 1880, *Palmer 1167*; 5 mi. west of Viesca, plant erect, *Johnston 7739*; Bolson de Mapimi, April 15, 1847, *Gregg 449*.

Suaeda suffrutescens is the most common and mostly widely distributed member of its genus in trans-Pecos Texas and along the Rio Grande and Pecos valleys in adjacent New Mexico. It extends south in northern Coahuila and Chihuahua. If not restricted to saline gypseous soils, it at least appears strongly to favor that substratum. The species is readily recognized because of its pubescence, abundant staminate flowers, and very moderately fleshy usually hairy perianth-lobes.

As originally described, the species was a complex. The specimens originally cited are *Berlandier 1345*, representing *S. nigrescens* from San Luis Potosi, and *Wright 578* in part and *Emory*, representative of the species as here taken. In subsequent usage the name *S. suffrutescens* has been applied to the present plant of Texas and to another, more western species, also with hairy herbage. The latter, *S. ramosissima* (Standl.) Johnston, was segregated and named by Standley, who redefined *S. suffrutescens* and gave its type-locality as "Western Texas." I have selected *Wright 578 in part* as the type-collection. This is part of a mixed sheet containing specimens obtained by Charles Wright at three different localities in trans-Pecos Texas and representing three different species, *S. suffrutescens* Wats., *S. duripes* Johnston, and *S. nigrescens* var. *glabra* Johnston. These were obtained at (1) Escondido Springs, about 20 miles east of Ft. Stockton, Aug. 17, 1849, (2) near Ft. Stockton, Aug. 18, 1849, and (3) near San Elizario, Oct. 4,

1849. Just which species was obtained at which locality cannot now be determined. The largest specimen on the sheet represents *S. suffrutescens* as here accepted. It was distinguished from the other material on the sheet by Watson and labeled by him "*S. suffrutescens*, W." It is a form of the species with the leaves only sparsely hairy. Watson's reference to the material collected by "*Emory*" is unintelligible unless it refers to the material treated by Torrey in the Botany of the Mexican Boundary, p. 184, as *Suaeda fruticosa* var. *multiflora*. Torrey cites collections of Bigelow from Presidio del Norte (i.e. Ojinaga) which probably represent *S. suffrutescens*, the common species at that locality, and collections of Thurber from the Rio Pecos, which perhaps represent *S. duripes*.

The plant of southern Coahuila, which I have distinguished as *S. suffrutescens* var. *detonsa*, differs from the more northern typical form of the species in having green glabrous leaves that contrast noticeably with the hairy stems. Its stems are usually densely hairy, occasionally, however, they are only sparsely so. Among the specimens which I have cited as representing the var. *detonsa*, Gregg 458 was referred to *S. diffusa* and Gregg's collection from the "Bolson de Mapimi" was referred to *S. Torreyana* when Watson originally published these latter species.

***Suaeda duripes*, sp. nov.**

Planta succulenta herbacea vel fruticosa 5–30 cm. alta; ramis gracilibus ut videtur ascendentibus vel decumbentibus, laevibus vel obscure vesiculato-tuberculatis, glabris vel pilis sparsissimis minutissimis obsitis; foliis succulentis linearibus vel oblongo-obovatis 3–7 mm. longis 1–3 mm. latis compressis, basim versus gradatim contractis, haud petiolatis, late affixis a basi usque ad 1–1.5 mm. supra basim induratis et in caule persistentibus, apice obtusis vel rotundis; glomerulis plurifloris, basi foliis haud vel breviter longioribus basim versus induratis enatis; bracteolis inconspicuis mox deciduis membranaceis triangularibus vel lanceolato-triangularibus saepe integris; perianthio infra medium lobato sub anthesi succulento maturitate vesiculoso et suberoso-incrassato depresso ca. 2–2.5 mm. diametro, lobis prominenter convexis; seminibus nigris erectis nitidis laevibus.

TEXAS: Pecos River, in salt soil, Nov. 1850, *Thurber 114* (TYPE, Gray Herb.); trans-Pecos Texas, 1849, *Wright 878 in part*.

A well marked species, apparently confined to Reeves and Pecos Counties, Texas, and characterized by thickened and persistent leaf-bases and the corky-thickened lobes of the fruiting calyx. The collection of Charles Wright is part of the mixed sheet which I have described above in my discussion of *S. suffrutescens*. It consists of small apparently annual plants less than a decimeter tall. Since Wright's field notes give his collection from San Elizario as a small bush, it is obvious that his material of *S. duripes* was collected either near the present Ft. Stockton or about 20 miles to the eastward, along the old San Antonio-El Paso wagon road, at the watering place which Wright called Escondido Springs. Thurber's material was collected along the northern wagon road to El Paso which crossed the Pecos about 50 miles south of the New Mexico boundary and then went up the west side of the river to Delaware Creek before continuing westward.

***Tidestromia carnosa* (Steyerm.), comb. nov.**

Cladothrix lanuginosa var. *carnosa* Steyerm., in Ann. Mo. Bot. Gard. **19**: 389 (1932).

Tidestromia lanuginosa var. *carnosa* Cory, in *Rhodora* **38**: 405 (1936).

This plant appears to be restricted to gypseous saline Upper Cretaceous clays and is known only from Brewster County, Texas, and south of Ojinaga, Chihuahua. South of Ojinaga I found it growing in close proximity to *T. lanuginosa*. The two species were so completely different in appearance and so constant in their differences that it seems surprising that they have continued to be treated only as variety and species. From the widely ranging *T. lanuginosa* the present species differs in the very fleshy yellowish green nearly glabrous herbage, more brittle stems, and more indurate involucre bearing subsessile leaves. These characters are constant in all the herbarium material I have examined. The closest relative of *T. carnosa* is *T. tenella* Johnston, of the gypseous soils in western Coahuila south of Laguna del Rey, from which it differs in having much coarser stems and leaves, flowers that dry brownish rather than white, and coarsely branched rather than minutely barbellate hairs along the stem and on the flowers. The three species *T. lanuginosa*, *T. carnosa*, and *T. tenella* are all annual herbs. The remaining species of the genus are all strong-rooted perennials.

***Tidestromia suffruticosa*, var. *coahuilana*, var. nov.**

A varietate typica differt indumento laeviore minus pruinoso, foliis involucreatis petiolatis, floribus mox glabris; caulibus rigidis distincte fruticosis.

COAHUILA: Sierra Cruces, 5 km. west of Picacho San José, limestone hillside, *Stewart 820*; Sierra Cruces, 5 mi. north of Santa Elena, stony bank, *Johnston & Muller 1014* (TYPE, Gray Herb.); Sierra del Pino, Cañon Ybarra, dry hillside, *Stewart 1855*; Lomas del Aparejo, east side of Llano de Guaje, *Johnston & Muller 773*; south end of Sierra del Pino, northeast of Armendais, rocky flat, *Johnston & Muller 363*; western base of grade over Cuesta Zozaya, limestone slopes, *Muller 3287* and *Johnston 9300*; Aguaje Pajarito, west end of Sierra Fragua, rocky ridges and slopes, *Johnston 8677*; 3 mi. west of Socorro, dry arroyo banks, *Johnston 8844*; Sierra Paila, Oct. 1910, *Purpus 4927*.

Typical *T. suffruticosa* was based upon material collected by Wright on mountain sides near Frontera, July 19, 1851, and on hills about 30 miles west of the Pecos, Aug. 18, 1849. Subsequent collections have been made in Brewster County, Texas, and in Dona Ana County, New Mexico. This typical form, of Texas and New Mexico, differs from the plant of central and western Coahuila in its looser pruinose indument, much less woody stems, permanently hairy flowers, and shorter petioles on the involucre leaves. These differences are not always strongly developed, but together they add up to appreciable differences in the gross aspects of the two plants. In Coahuila the plant is most commonly found on planed down upper Cretaceous beds at the base of anticlinal mountains and is usually associated with *Dyssodia acerosa* and *Coldenia hispidissima* and other indicators of somewhat gypseous soil. The localities at which the typical form of *T. suffruticosa* has been collected suggest that it too may select rocky soils containing at least some gypsum.

***Tidestromia rhizomatosa* sp. nov.**

Planta perennis prostrata ramosa grisea pilis ramosis vestita; rhizomatibus laevibus brunneis gracilibus; caulibus 1-2 mm. crassis griseis 1-2 dm. longis basi gemmis albis parvis donatis, internodiis 5-20 mm. longis; foliis carnosis saepe plus minusve reflexis et plano-convexis subtus conspicue crassinerviis, inferioribus obovatis 5-12 mm. longis 5-10 mm. latis, maturitate plus minusve glabrescentibus, supra medium latioribus deinde basim versus gradatim attenuatis, apice rotundis vel obtusis, superioribus ovatis sessilibus; glomerulis 1- vel 2-floris; floribus lacteis 3 mm. longis; lobis perianthii obtusiusculis ovato-oblongis ad 3 mm. longis 1-1.2 mm. latis quam bracteis lateralibus circa duplo longioribus, extus basim versus glaberrimis brunnescentibus alibi tomentosis; tubo staminali 0.4-0.5 mm. alto staminodia 5 et filamentas 5 gerentibus; filamentis subulatis 0.7-0.9(-1.2) mm. longis, antheras ad 1 mm. longas 4-5-plo longiores quam latas gerentibus; staminodeis subulatis quam filamentis 1/5-1/2 brevioribus; ovario globoso; stigmate profunde bilobato; semine ad 1.3 mm. longo erecto brunnescente ovoideo.

COAHUILA: Near El Anteojo, about 3 miles west of Cuatro Cienegas, with *Allenrolfea* on a silty saline, probably also gypseous, flat just east of the pond, locally abundant, decidedly prostrate, grayish, rhizomatous, leaves fleshy and more or less reflexed, Sept. 5, 1941, *Johnston 8873* (TYPE, Gray Herb.).

A perennial species with the stems flat on the soil and spreading underground by slender smooth rhizomes. The leaves are fleshy, thinly clothed with trichomes, and more or less plano-convex and reflexed. They are very strongly veined beneath. The species is most closely related to *T. gemmata*, from which it differs in its rhizomes, lank more elongate stems, more or less glabrescent more fleshy reflexed leaves, slightly larger flowers, and the development of staminodes. The well developed staminodes distinguish the species from all its congeners save only *T. oblongifolia* (Wats.) Standley, of California and Arizona. The plant is probably a halophytic gypsophile.

***Tidestromia gemmata*, sp. nov.**

Planta perennis pilis ramosis dense vestita, e radice valida palari profunda apice gemmis conspicuis albo-tomentosis donata et non raro caudicem compactam proferente oriens; caulibus laxe ramosis prostratis vel decumbentibus rubiginosis pilis griseis vestitis 1.5-2.3 mm. crassis 1-1.5 dm. longis, internodiis 1-2.5 cm. longis; foliis juvenilibus albis vel cinereis, maturis dilute flavescentibus; foliis inferioribus conspicue petiolatis, lamina 12-15(-23) mm. longa 1-1.6 mm. lata, subtus prominenter nervata, apice obtusa vel rotundata, basi truncata vel obtusa in petiolum 4-8(-10) mm. longum abrupte contracta; foliis superioribus numerosis ovatis subsessilibus sursum gradatim reductis; glomerulis 2-4-floris; floribus lacteis 2.5 mm. longis; lobis perianthii ad 2 mm. longis lanceolato-oblongis vel ovato-oblongis obtusiusculis quam bracteis lateralibus circa duplo longioribus, extus basim versus glabris alibi praesertim medium versus tomentosis; tubo staminali 0.6-0.7 mm. alto; staminodeis nullis; filamentis 0.8-1.2 mm. longis; antheris oblongis 0.8-1 mm. longis.

COAHUILA: Just south of Matrimonio Viejo, restricted to gypsiferous shales, prostrate, common, Sept. 22, 1941, *Johnston 9363* (TYPE, Gray Herb.); just east of Ameri-

canos, on cemented gravels capping gypsum, prostrate, locally common, Sept. 23, 1941, Johnston 9379; 20 km. southeast of Rancho Alegre on road to Acatita, on flats, prostrate, common, Sept. 20, 1942, Stewart 2668.

This species superficially resembles coarse plants of *T. lanuginosa*, but differs in its coarse very strong tap-root, conspicuous large cottony buds borne near the surface of the soil, slightly more fruticulose reddish stems, and thicker more strongly veined leaves. I first recognized the distinctness of the species near Matrimonio, where I found it growing near specimens of the common and widely distributed annual, *T. lanuginosa*. I suspect that the *Tidestromias* I noted as growing in gypsum seams in the shales south of Laguna de Leche may also belong to *T. gemmata*.

***Spiraea Northcraftii*, sp. nov.**

Frutex; ramulis gracilibus rigidis laxe ascendentibus vel subdivaricatis glaberrimis, vetustioribus griseis subspinescentibus, juventute castaneis; foliis minutis numerosis crassis laevibus enervatis obscure costatis pallidulis glaberrimis solitariis vel plus minusve fasciculatis integerrimis oblanceolatis, 3–8 mm. longis 1–2.5 mm. latis, apicem versus latioribus deinde basim versus in petiolum 0.5–1 mm. longum subcastaneum gradatim contractis, apice rotundis vel obtusis abrupte conspicue mucronatis; inflorescentia terminali subcorymbosa 8–15-flora plus minusve hemisphaerica ca. 8 mm. diametro glabra, bracteis linearibus 1–1.5 mm. longis, pedicellis 1–1.5 mm. longis, hypanthio 1.5 mm. alto et diametro, lobis triangularibus ad 1 mm. longis valvatis intus sparse tomentulosus; petalis albis 1.5–2 mm. longis 1–1.3 mm. latis, margine erosis; staminibus 15, filamentis linearibus 1.5 mm. longis; carpellis 2 vel 3 glaberrimis; folliculis non visis.

COAHUILA: Summit of Picacho de Jimulco, 13 km. east of Jimulco, in thick underbrush in woodland association with oak, pine and juniper, June 29, 1941, Stanford, Retherford & Northcraft 115 (TYPE, Gray Herb.).

A microphyllous shrub related to *S. Hartwegiana* Rydb., of Hidalgo, Puebla and Oaxaca, from which it differs in being smaller in all parts, and in having a shorter less elongate hypanthium and a dense few-flowered subcorymbose rather than an elongate many-flowered racemose inflorescence.

***Vauquelinia Retherfordii*, sp. nov.**

Frutex 3 m. altus; ramulis cortice grisea glabra obtectis; foliis apice ramulorum confertis lineari-oblongis 2–5 cm. longis 4–7 mm. latis, basim versus in petiolum 2–4 mm. longum pallidum abrupte contractis, supra viridibus inconspicue sparseque puberulentis canaliculatis sed inconspicue minuteque reticulatis, subtus pallidis tomentulosis pilis mollibus contortis brevibus albis dense vestitis maturitate aliquantulum deciduis, margine utrinque dentibus 15–20 parvis ascendentibus donatis, apice obtusis; corymbo terminali 2–3 cm. diametro 10–30-floro, ramulis tomentulosis; hypanthio hemisphaerico 3–4 mm. diametro dense puberulente; sepalis ovatis intus tomentulosus; petalis ellipticis albis ad 4 mm. longis ca. 2 mm. latis integerrimis; staminibus 12–15, filamentis linearibus ca. 3 mm. longis; capsulis submaturis globoso-ovoideis ca. 3 mm. diametro.

COAHUILA: Sierra Jimulco, about 11 km. northeast of Jimulco, in rolling hills covered with *Agave*, *Yucca* and low mesquites, Stanford, Retherford & Northcraft 87 (TYPE, Gray Herb.).

A species related to *V. californica*, from which it differs in its smaller

narrow elongate short-petiolate leaves clustered on short-shoots, its permanently tomentulose lower leaf-faces, and its small few-flowered corymbs.

***Thamnosma Stanfordii*, sp. nov.**

Frutex 6 dm. altus ramosissimus glaberrimus; ramulis teretibus tuberculatis 1–2 mm. crassis foliosis evanescentes glaucis; foliis numerosis confertis lineari-oblongatis vel linearibus compressis 7–12 mm. longis 0.8–1.5 mm. latis, medium versus usque ad apicem versus latioribus, costatis sed enervatis, juventute subglaucis, margine minute sed distincte sinuatis; floribus 1 vel 2 extra-axillaribus apicem ramuli versus gestis; pedicellis 1.5–2 mm. longis, fructiferis ad 5 mm. longis; calyce ca. 4 mm. longo infra medium lobato, lobis triangulari-oblongis ca. 3 mm. longis obtusis purpurascensibus basi ad 2 mm. latis; corolla alba purpurascens; petalis 4, ad 10 mm. longis, oblongo-ovatis (infra medium ad 4 mm. latis) acutis; filamentis 4 exterioribus ad 5 mm. longis; filamentis 4 oppositipetalis 3 mm. longis linearibus; antheris ellipsoideis ca. 1.5 mm. longis; stylo stamina superante; capsula stipite ad 1 mm. longo incluso 1 cm. longa, ca. 6 mm. lata, apice ca. 2 mm. profunde bilobata.

COAHUILA: Sierra de Jimulco, 11 km. northeast of Jimulco, rolling hills with *Agave*, *Yucca* and low mesquites, plant 2 ft. tall, fl. purple, fennel-like odor, June 27, 1941, Stanford, Retherford & Northcraft 16 (TYPE, Gray Herb.).

A very distinct addition to this small genus of North America and Africa. In its strongly biseriate stamens and in its bushy growth-habit it departs widely from the three American species previously described. It is a much-branched slender-stemmed bush with numerous leaves. The leaves somewhat suggest those of *T. texana*. The large flowers superficially resemble those of *T. montana*. The capsule most suggests that of *T. texana* but is larger and more elongate. The stamens in *T. texana* and *T. montana* (flowers not known in *T. trifoliata*) are subequal. In *T. Stanfordii* the filaments of the inner whorl of stamens are very conspicuously shorter than those of the outer whorl.

***Pseudosmodingium* ? *anomalum*, sp. nov.**

Frutex erectus ca. 2.5 m. altus; ramulis vetustioribus cortice grisea glabra obtectis, hornotinis dense puberulentis; foliis submaturis (vetustioribus non visis) simplicibus angustissimis integerrimis minute puberulentis apice ramulorum confertis, 2–5 cm. longis 2–3 mm. latis, utrinque attenuatis costatis sed haud vel vix nervatis, 1–2 mm. longe petiolatis; paniculis sub anthesi (fructiferis non visis) 4–5 cm. longis elongatis sparsifloris sparse ramosis minute sparse puberulentis quam foliis subduplo longioribus, axi paniculae gracillimo parte 1/3 raro ad 1/2 inferiore nudo deinde sursum ramulos 3 vel 4 gracillimos 3–12 mm. distantes ascendentes sparsifloros 3–10 mm. longos simplices vel raro pauciramosos gerente; bracteis linearibus 1–2 mm. longis; floribus minutis 5-meris; pedicellis gracillimis 1–3 mm. longis; sepalis ca. 0.6 mm. longis et latis triangularibus apice rotundis basi abrupte constrictis; petalis imbricatis ellipticis vel elliptico-ovatis, 1.5 mm. longis 1.2 mm. latis, medium versus vel infra medium latioribus, apice rotundis, basi subtruncatis; disco patelliformi; antheris ca. 0.5 mm. longis et latis, basi cordatis, apice rotundis; filamentis subulatis ca. 0.6 mm. longis latere exteriori disci affixis; ovario sessili glabro stigmatibus 3 tuberculatis terminato; fructu ignoto.

COAHUILA: Sierra de Jimulco, about 11 km. northeast of Jimulco, along arroyo in rolling hills covered with *Agave*, *Yucca* and low mesquites, plant uncommon, erect, 8 ft. tall, June 28, 1941, *Stanford, Retherford & Northcraft* 73 (TYPE, Gray Herb.).

A deciduous shrub with slender woody stems bearing scattered clusters of elongate simple entire leaves on short-shoots. The type material shows nearly fully grown new leaves and well developed inflorescences with the flowers at anthesis. Without fruit the generic position of the plant is necessarily uncertain. I have placed it in *Pseudosmodium* because in that genus I find leaves clustered on similar short-shoots, panicles of similar position and form, and flowers of similar appearance and structure. Prof. Irving W. Bailey reports that the wood of the plant is also suggestive of the genus. The described species of *Pseudosmodium*, however, have well developed imparipinnate leaves. The leaves are distinctly simple in the present plant. Their obscure veining shows that they are not phyllodal and the absence of a secondary basal articulation gives no indication that they might be the terminal leaflet of an otherwise suppressed pinnate leaf.

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PUBLICATION DATES FOR THE BOTANICAL PARTS OF THE PACIFIC RAILROAD REPORTS

IVAN M. JOHNSTON

IN the present paper I present such data as I have been able to assemble concerning the exact dates of publication of the various botanical papers contained in the Pacific Railroad Reports. These reports, based upon explorations in the western United States between 1853 and 1855, and published by the War Department under the lengthy title, "Reports of Explorations and Surveys for a Railroad Route from the Mississippi River to the Pacific Ocean," include important botanical papers by Torrey, Gray, Engelmann, and others, in which were first described a large number of the characteristic West American plants. A study of the various volumes of the Pacific Railroad Reports reveals puzzling discrepancies between dates found on the title pages of the volumes, those on the initial leaf of the separate reports within each volume, and those found scattered through the text. In a search for precise information regarding the dates of publication of the botanical portions of the Pacific Railroad Reports, I have consulted the Historic Letter File at the Gray Herbarium and searched for contemporary mention of these papers. The letters of John Torrey and George Engelmann have supplied much detailed information.¹ The published proceedings of the Academy of Natural Sciences of Philadelphia, the American Philosophical Society, and the Academy of Science of St. Louis have also provided exact dates at which copies of the completed volumes of the Reports had been distributed from Washington. From these sources it has been possible to assign reasonably exact dates to the various botanical reports, accurate in most cases to within a month or two. In less disturbed times, when at least Torrey's letters at Kew and St. Louis and Gray's letters at Kew, New York, and St. Louis can be examined, it seems probable that additional information may be found which will establish an even more precise dating for these papers.

¹Contemporary letters also help to date Torrey's and Engelmann's important botanical reports in vol. 2 of Emory's Report on the United States and Mexican Boundary Survey. Torrey wrote Gray, on Jan. 10, 1859, that he was preparing a list of errata from page-proof of his Mexican Boundary Report. Engelmann wrote Gray on April 5, 1859, that he had ordered separates of his account of the boundary Cacti but did not know if his report had been printed. On June 7, 1859, Torrey was expecting his printed report. Schott (in a letter at the N. Y. Botanical Garden, *fide* notation in the Gray Herbarium copy) stated that the botanical reports were issued before April 21, 1859. On June 2, 1859, Engelmann wrote Gray that he had seen the printed report, and on June 6, the volume was displayed at the session of the St. Louis Academy. Engelmann, in Sept., 1859, wrote that his separates were still in Washington and yet undistributed. The second volume of the Boundary Survey was obviously issued in May or late April, 1859. No advance separates of the botanical reports were issued.

The Pacific Railroad Reports appeared in two editions, first in octavo and later, much enlarged in scope, in quarto. In explanation of this procedure Torrey wrote Gray, on Sept. 14, 1854, "This [Lieut. Whipple's report] will be printed in the ordinary *pub. doc.* & then a revised edition will be ordered in which our illustrations can come & any additional descriptions & observations that may be ready. He says this is the only way, or the Natural History may be thrown out altogether."

The octavo first edition of the Pacific Railroad Reports appeared as House Executive Document no. 129, 33rd Congress, 1st Session. Announced as a three-volume work, only two volumes of text were published. There are only two botanical reports in the octavo edition, Torrey's catalogue of the plants collected on the Pope Expedition and Bigelow's account of the forest trees and vegetation observed during the Whipple Expedition. These botanical reports were not illustrated. Bigelow's report was reprinted apparently without change, in the second, quarto, edition of the Reports. The account of the plants collected on the Pope Expedition, a taxonomic paper, was subsequently much changed in the second edition and merits special comment.

The botanical report of the Pope Expedition appeared on pp. 307–324 of part 2, of volume 2, of the octavo edition. Although Torrey wrote Gray, on Nov. 4, 1854, just after he had sent the manuscript of this report to Washington, that, "You have had a larger share in the Catalogue than I . . .," the catalogue as published gives Torrey as sole author. This first edition of the botanical report on the Pope plants has become a forgotten item in the literature of West American botany. There is no copy of the report at the Gray Herbarium, and Dr. H. W. Rickett (in lit. Aug., 1942) writes that there is none in the library of the New York Botanical Garden. In their later writings Torrey and Gray, apparently considering the octavo report as a preliminary one and superseded by the enlarged and changed quarto edition published about two years later, invariably cited only the second edition of the Pope Report. Later botanists, unaware of the early edition, have done the same. The first edition of the Pope Report can be dated reasonably well. The publication of the octavo edition of the Pacific Railroad Reports is noted in the American Journal of Science (20: 299) for September 1855. Engelmann, however, saw the publication several months earlier, for, writing Gray on June 12, 1855, he states, "I see in some of the Pacific Railroad Reports Torrey has mentioned without describing several new *Euphorbia* coll. before by Wright or Fendler — going ahead of me — but it serves me right." The first edition of the Pope Report, accordingly, must have appeared before the middle of 1855, probably in the spring of that year.

The following three specific names, none listed in Index Kewensis, were published in the first edition of Pope's Report and abandoned in the second edition: *Ehretia ? hispida*, nomen (p. 320), *Stegnocarpus ? Ciocarya* (p. 320), and *Camassia Gawleri* (p. 323). In the second edition they are replaced by the following newly published names: *Eddya hispidissima*,

Stegnocarpus canescens, and *Camassia Fraseri*. The names *Eritrichium crassisepalum* (p. 321), *Euphorbia Wrightii* (p. 321), *Euphorbia dilatata* (p. 321), *Euphorbia albomarginata* (p. 321), and *Euphorbia Fendleri* (p. 321), nomina nuda in the first edition, were supplied with descriptions in the second edition. The well-known species *Selenia dissecta* (p. 308), *Stenandrium barbatum* (p. 317), and *Pentstemon Fendleri* (p. 318) were well-described in the first edition of the report. The species *Astrophyllum dumosum*, *Ammoselinum Popei*, *Phacelia Popei*, *Eritrichium pusillum*, and *Ptilocalyx Greggii*, published in the second edition, are not mentioned, at least by name, in the first edition.

The second edition of the Pacific Railroad Survey Reports was published in sumptuous quarto volumes. The text of the first edition was reprinted with few changes, and many new special reports with many plates were added. This second edition is the one represented in most libraries. It appeared in two forms, differing only in title-page, as Senate Executive Document no. 78, and as House Executive Document no. 91, both of the 33rd Congress, 2nd Session. As originally planned the work contained eleven volumes. Subsequently two more volumes (numbered vol. 12, pt. 1, and 12, pt. 2) were added and published as House Executive Document 56, 36th Congress, 1st Session. In the completed work, botanical reports are found in volumes no. 2, 4, 5, 6, 7, and 12².

Volume 2 of the quarto reports contains the botanical reports for the Beckwith and the Gunnison Expeditions, and the second edition of the botanical report for the Pope Expedition. These reports are by Torrey and Gray. The complete volume was issued at Washington in 1857. Within this volume Captain Pope's "Explanatory Note to the Geological Report" bears the printed date Feb. 18, 1857. Torrey, in a letter to Engelmann dated July 30, 1857 (quoted by Rodgers in his book "John Torrey," p. 248), speaks of the Beckwith and Pope reports as "contained in a volume [of the Pacific Railroad Reports] just published. . ." On October 6, 1857, the volume had been received from Washington and accessioned at the Philadelphia Academy.

Torrey and Gray had reprints of the botanical reports published in vol. 2 before the end of June 1857. On Oct. 20, 1855, Torrey had written Gray that the botany of the Beckwith (and Gunnison) report was printed and that separates were ordered. In his letter of Jan. 9, 1856, he stated that the botany of the Pope report was not yet printed, and on March 12, 1856, he asked if Sprague was still at work on the plates for that report. The authors seem to have received the printed plates for the Pope Report shortly before Torrey's letter of June 23, 1857. At that time Torrey wrote, "You probably rec'd from me, lately, a parcel containing 50 sets of plates for Bot. Pope. You can return the 10 extra copies of the Beckwith letter-press, or I will send you the plates for them — just as you like. My parcel for England will go soon. A friend will take care of it. I will send Pope's and Beckwith's Rep. to Hooker, etc." The botanical parts of the Pope and Beckwith-Gunnison reports are apparently those acknowledged and commented upon by Sir William Hooker in his letter to Gray, dated Nov. 27,

1857. These same reports (with complete text and plates) were reviewed by Hooker in the final issue of the *Kew Journal of Botany*, 9: 376 (Dec. 1857). He states that the botany of the Beckwith-Gunnison reports was "Published January 7, 1857." No such date is given for the botany of the Pope Report. Torrey's letter of June 23, 1857 (already quoted above) does seem to infer that the complete botany of the Beckwith-Gunnison report and at least the text of the botany of the Pope Report had been in the hands of the authors for some time. While Hooker may have been correct in stating that the botanical part of the Beckwith-Gunnison Report had been "published January 7, 1857," there is no evidence that it was distributed by the authors until after June 1857, and little if at all before the time when the whole of vol. 2 was available to the general public at Washington. I believe that the effective dates of publication of the botanical reports for the Beckwith-Gunnison and Pope expeditions is either June or early July, 1857. This date is two years later than the date of publication for the botanical appendix in the first (octavo) edition of Pope's Report.

Volume 4 of the quarto reports contains the important botanical catalogues by Torrey, Engelmann, Bigelow, and Sullivant, based upon material assembled during Whipple's Expedition.

On May 22, 1857, Torrey wrote Gray that the text of his part of the Whipple Report was printed and that he was preparing the index, and on July 22, 1857, that his extra copies were ready but the plates were still unprinted. On Aug. 12, 1857, he wrote, "A day or two ago I was surprised to get from Dr. Bigelow a printed copy of the Bot. of Whipple's Exped. containing our portion, together with the Cactaceae, an introductory article on the Bot. Geography explored & a memoir on the principal forest trees found on the route . . . I have 150 copies of the plates of Cactaceae, which were intended for extra copies of text that Dr. B. promised, long ago, to have struck off. I did not learn till yesterday that the lithographer had printed these. My own extra copies of Bot. have not yet arrived, & I rather think that they may include Bigelow's articles." On Aug. 22, 1857, having just returned from Montreal, Torrey wrote, "My extra copies of Plant. Whipple have not arrived, but I found a single one (sent by Express) on my table this morning. It contains Bigelow's two reports & Sullivant's Mosses, the latter not in a previous copy sent two weeks ago. I am mortified to find so many typographical errors . . . Perhaps the Superintendent of Public Printing will authorize the insertion of the *errata list* in all copies." On Sept. 2, 1857, Torrey received word from Washington that 150 copies of the botanical report had been shipped to him. These arrived by Sept. 10th, when he wrote, "They do not contain Bigelow's article, Cactaceae, nor Sullivant's mosses. So if the Cactaceae have not been received for Engelmann we must fall back on Bigelow for these, who has 200 copies of the entire Botany. I have 200 copies of the Cact. plates . . . We can distribute our part of the Botany without Bigelow's, & your 50 copies shall be sent as soon as I can get them ready — but you had better not distribute till we get *errata* printed." Engelmann, travelling in Europe, did not get

his reprints until May, 1858. C. W. Short (Louisville, Kentucky) wrote Gray on Sept. 10, 1857, "Mr. Sullivant has been so good as to send me a copy of his very beautiful Mosses of Whipple's survey." Although the volume of the Pacific Railroad Reports containing the Whipple Reports was only received at the Boston Society of Natural History on Jan. 1, 1858, at the Philadelphia Academy on Jan. 5, 1858, and at the St. Louis Academy on March 8, 1858, and was first reviewed in the American Journal of Science (25: 149) for Jan., 1858, the evidence is clear that Torrey, Gray, Bigelow, and Sullivant had sufficient copies of the botanical portions of the Whipple Report to establish Sept. 1857 as the effective date of issuance for this important botanical volume.

Volume 5 of the quarto reports contains the two botanical reports based on the collections of the Williamson Expeditions, one by Torrey, the other by Durand & Hilgard. The substance of the Durand & Hilgard report first appeared as "*Plantae Heermannianae*" in the Journal of the Philadelphia Academy 3: 37-46 (Nov. 1854). A reprint of this article was sent Gray by Durand with a covering letter dated Dec. 4, 1854. The revised report on the Heermann collections was in print at Washington before Sept. 2, 1857, for on that date Torrey wrote that, by some mistake, he had received 150 copies of Durand & Hilgard's report intended for the authors.

Torrey's report, on the plants collected by Blake during the Williamson Expeditions, was probably printed much later. Concerning this report there is only one reference in his letters which may be significant. On June 12, 1858, he wrote Gray, "As to those plates of Blake and Antisell's Repts. I don't mean to let you pay for any unless I learn that some extra copies of the letter press can be obtained from the Public Printer." The whole volume, containing Torrey's report, was displayed at the St. Louis Academy on March 22, 1858. There is no reason for believing that Torrey received advance reprints. The effective date of Torrey's report is probably the date of issuance of the complete volume in Washington, about Feb., 1858.

Volume 6 of the quarto reports contains the botanical reports resulting from the Williamson & Abbot Expeditions in 1855. The botanical reports were organized and partially written by J. S. Newberry. On July 23, 1857, Newberry, in ill health, wrote Gray, asking him to read all the proofs of the botanical report which would soon become available. On Sept. 2, 1857, after learning that Newberry was to join a new expedition in the West, Torrey wrote Gray, "What is to be done with Newberry's Report? If he goes with Ives you will probably attend to proof reading . . ." On April 5, 1858, the completed volume was displayed at the session of the St. Louis Academy. The volume probably first appeared in Washington in March, 1858.

Volume 7 of the quarto reports contains Torrey's report on the collections of Parke's Expedition. On Sept. 10, 1857, Torrey wrote, "Two days ago I rec'd proofsheets of a small report that I prepared for Antisell (Parke's Exped.). An officer saw them & begged . . . that I might see them before being worked off. They permitted him to do so but said, if the sheets were not returned by next mail, the printer should proceed without corrections.

Part of the work had already been printed & I did not know that it was in press!" Torrey's letter of June 12, 1858, already quoted in connection with his account of Blake's plants (vol. 5), is the only other reference to this report in his letters to Gray. F. W. Vaughn, writing for A. A. Humphreys of the Office of the Pacific Railroad Surveys, wrote Gray on May 8, 1858, that volumes 5, 6, and 7 of the reports were being sent him. Volume 7 was available at the Philadelphia Academy May 11, 1858, and was displayed at the St. Louis Academy on May 17, 1858. The volume probably came from the press in Washington in April 1858.

Volume 12, part 2, of the quarto reports contained the final expanded report of Stevens' explorations across the northern United States. The botanical papers it contains are written by Gray and Cooper. I have no detailed information concerning this report. The publication of the report was authorized by the U. S. House of Representatives on March 25, 1860. The volume was received at the Boston Society of Natural History on Feb. 12, 1861. It was displayed at the St. Louis Academy on June 17, 1861. The Library of Harvard University did not receive its copy until Aug. 19, 1861. The volume, accordingly, was published probably late in 1860 or in Jan. 1861.

The dates of publication for the botanical papers published in the two editions of the Pacific Railroad Reports may be summarized as follows:

FIRST EDITION (in octavo)

Volume 2:	Botany of the Pope Report, by Torrey	before June 1855
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SECOND EDITION (in quarto)

Volume 2:	Botany of Beckwith and Gunnison Reports, by Torrey & Gray	about the middle of 1857
	Botany of Pope Report (2nd edition), by Torrey & Gray	about the middle of 1857
Volume 4:	Botany of the Whipple Report	advance reprints Sept. 1857
Volume 5:	Botany of Williamson Report: Heermann collections, by Durand & Hilgard	advance reprints Sept. 1857
	Blake collections, by Torrey	about Feb. 1858
Volume 6:	Botany of Williamson & Abbot Report	about March 1858
Volume 7:	Botany of Parke Report, by Torrey	about April 1858
Volume 12 ² :	Botany of Stevens Report	Jan. 1861 or late 1860

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